Network

Railways of Australia Quarterly

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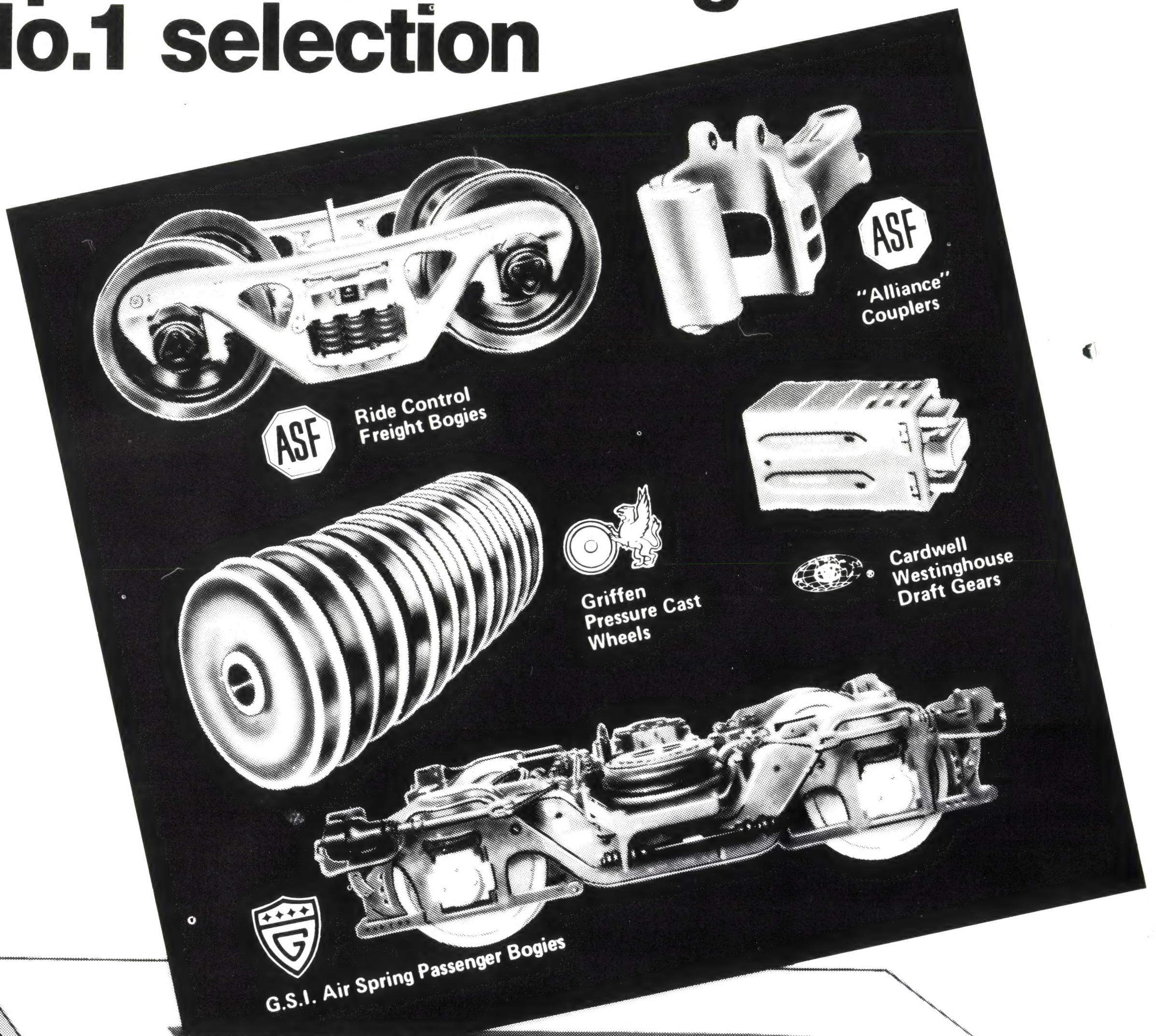

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- *Queensland Railways*
- *State Rail Authority of New South Wales*
- *State Transport Authority — Victoria (V/Line)*
- *Western Australian Government Railways (Westrail)*

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- *Metropolitan Transit Authority of Victoria*
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Editor: Alex Greig

Advertising Enquiries:

Advertising Enquiries should be addressed to The Advertising Manager, Railways of Australia 'Network', 4th Floor, 85 Queen Street, Melbourne, Vic. 3000.
Tel: (03) 608 0811. Telex: AA31109.
or the following State representatives:

N.S.W.: Patrick Carr, Commercial Union Assurance Building, 109 Pitt Street, Sydney, N.S.W. 2000. Tel. 232 1026, 232 8072

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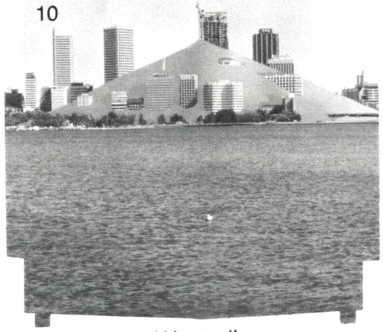

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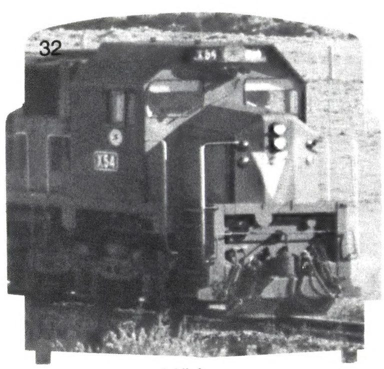

V/Line

Australian National

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Sydney Terminal revisited by the completely restored 3801 introduced in January 1943 the C-38 Class Pacific (4-6-2) locomotives provided outstanding service in New South Wales until well into the sixties. Restored after almost two decades out of service, 3801 will play a leading role in the coming Bicentennial celebrations.

Our only requirement of writers and personalities who contribute to Network is that they be informative or entertaining and that their subject has relevance to the wide interests of railwaymen today. Naturally, there will be occasions when their viewpoints or opinions run contrary to those of the editor or to Railways of Australia. We must accept that these differences are among the elements essential to the presentation of a lively and interesting magazine.

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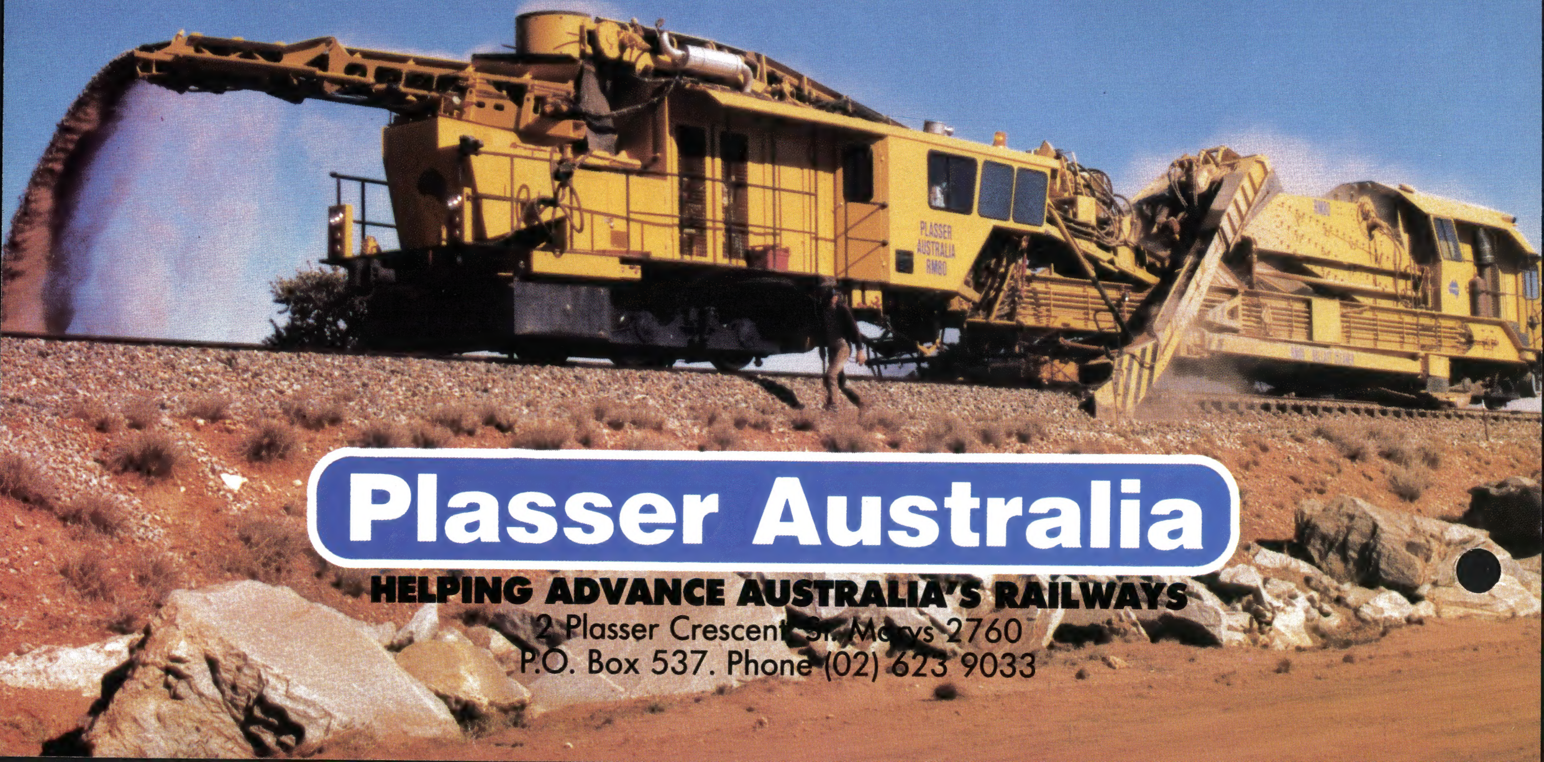

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The
EXECUTIVE DIRECTOR'S
column

Vandalism and public security

Two of the problems which beset railway managements in Australia are the increasing incidence of vandalism, and the growing threat posed to the security of passengers and staff by criminal elements in the community.

Neither development is confined to the transport industry, but the costs of it in the sphere with which we are concerned are tremendous. In the Melbourne area alone, the Metropolitan Transit Authority of Victoria estimates its costs of counteracting vandalism to buildings and vehicles at over $5 million annually.

It was with this as a background that Railways of Australia convened a two-day conference in February, to exchange information on the approaches taken by various rail Systems in coping with these twin problems. Because other forms of public transport experience the same difficulties, ROA invited representatives from government and private bus, tram and ferry operations throughout Australia to participate. They did so, and provided valuable input. As Chairman of the conference, I felt constrained to point out to delegates that we would be unlikely to solve the problems immediately. They have manifested themselves throughout the world, and differing remedies have been adopted in differing areas — there is no one, easy, solution.

It became apparent that the problems are most severe in large communities. Smaller cities seem to identify themselves more closely with their means of public transport and indeed with their public property — and vandalism is not so rampant. In like manner, country rail services do not experience the same degrees of vandalistic behaviour as we find in urban centres.

During the two days, discussions were wide-ranging in their scope.

The strong feeling emerged that media coverage of vandalism, graffiti writing, and attacks on passengers and transport staff had an adverse effect. It seems that those members of our community intent on pursuing these anti-social objectives are encouraged if they read the results of their efforts, or of the efforts of others, in the press — or see them on television. However, all participants felt that a direct educational approach from transport operators to the community — through schools, community groups and similar opportunities was beneficial.

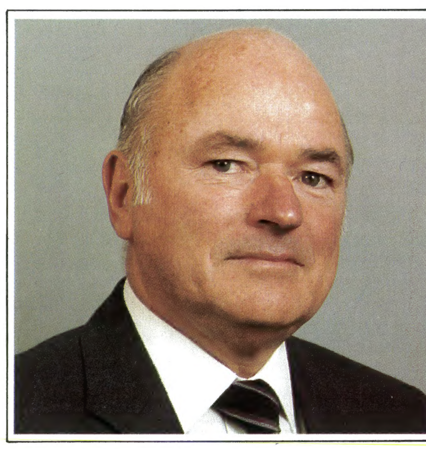
The operator's message, without intermediate interpretation or interference, can be brought home in this way. Transport authorities tackle the task in a variety of ways — uniformed or non-uniformed investigation officers will talk to groups; incidents of vandalism are sheeted home to schools by, for example, driving a defaced bus right into the heart of the school grounds; groups are encouraged to take responsibility for buildings such as bus shelters in their area. And some rail authorities have found it advantageous to place professionally painted murals of a "modern" artistic style on walls or buildings which might otherwise be vulnerable to graffiti writers.

Transport staff have been subjected to personal attacks, and the conference exchanged views on how these risks might be minimised. At attended railway stations, security should be of a high order at off-peak hours, particularly in the evenings. Staff are being properly trained in how to minimise the risks to themselves — and provision of instant communication to a suitable headquarters is seen as vitally important. The increasing use of two-way radio on all our suburban networks is contributing to this feeling of security for both passengers and crew alike.

Railways, as the principal mover of large volumes of commuters in most of Australia's capital cities are alive to their responsibilities. Their task is to ensure that their customers travel safely and securely — and that they ***continue*** to travel, for this is our business. Vandalised and defaced equipment at buildings discourages the use of public transport.

I hope that you, as a reader of this journal and obviously interested in our railways, will do your part to assist in stamping out two most undesirable trends evident in our community, as they apply to rail property. Reporting of incidents to rail staff or the local police will assist us to provide the Australian travelling public with the safe, comfortable, travel for which they pay.

M. C. G. SCHRADER
EXECUTIVE DIRECTOR



M. C. G. Schrader

. . . an escalating toll

Australian Railway

An 8-man Australian Railway Technical Mission that visited the People's Republic of China from September 1 to 16 last year has reported a definite Chinese interest in formalised inter-Railway exchanges.

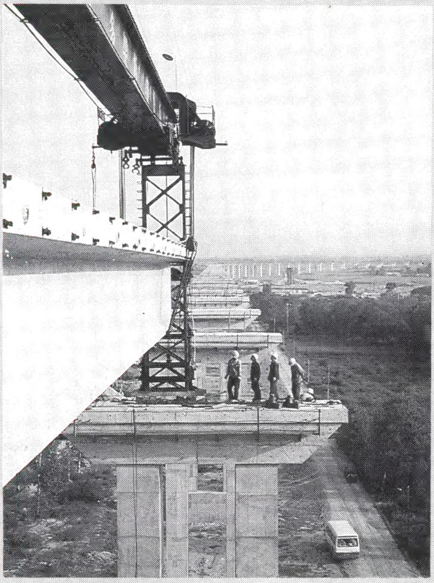
Led by Dr. Don Williams, the General Manager of Australian National, the Australian group's objectives were to bring the wider railway communities of the two countries together, establish a framework for railway technical co-operation and identify areas of mutual interest for railway economic co-operation.

The visit followed earlier exchanges at the national transport planning level, and led to a meeting of minds between Chinese and Australian railway professionals in the Chinese environment.

Agreements Reached

This agreement was reflected in a protocol summary of discussions, signed during the visit by Mr. Tu Yourui, the Chief Engineer of the Chinese Ministry of Railways (MOR) and Dr. Williams.

The protocol (since ratified by the Railways of Australia Committee) noted the common strengths and areas of interest between the two systems and the prospects for co-operation involving information exchange, visits, technical co-operation and joint economic undertakings in third countries.



Launching a pre-stressed concrete girder on the new Daquin heavy-haul coal railway. The viaduct over this broad, shallow valley is 2.5 km long. The ruling grade is 1 in 200.

The protocol identified specific Australian techniques of interest to China and vice-versa and nominated channels of contact.

The principles of funding the costs of such visits were also agreed between the railways.

Miss Tang Wensheng, the Director of the MOR Foreign Affairs Bureau, played a major part in achieving the understanding.

A fluent linguist, her skills eased the Australian team through the many difficulties that can exist when attempts are made — even by friendly professionals — to bridge two cultures.

There are pitfalls even in so simple a matter as the ordering of numerals, as the Chinese count in tens of thousands — which means translators must be mental arithmeticians as well.

This creates hazards of misunderstanding for the unwary visitor who fails to write the numbers down with ***all*** the zeros.

For the technical discussions with the Australian team in Beijing, the MOR fielded a team of 15 top Chinese railwaymen covering all key disciplines and Bureau of the Ministry; other senior people in the regional operating Administrations were equally unstinting in giving up their time.

Dr. Williams' Australian team included Messrs Ron Christie and Tony Boland from SRA of NSW; Gavin Boyd and Keith Wood of QR; and Brian Cornish of Westrail.

The Australian railway union movement was represented by Ron Bradford of the AFULE, the industry by ARIC's Deputy Chairman John Kuchler, and the Mission Manager was Ian Macfarlane, AUSTRADE's Manager, Railways.

The programme was also marked by generous hospitality by the Chinese hosts, including several well-chosen cultural outings and events. The highlight was conversation and dinner in the Great Hall of the People, with His Excellency Mr. Ding Buan'an, the Chinese Minister of Railways.

Traffic Task

In recent years, much has been written in the West about the Chinese Railways — a system of 52,000 route km of which some 10,000 km are double track, 3,000 km electrified at 25kV ac, and 12,000 km of route wholly dieselised.

China's railway routes are only 25% longer than Australia's, but with the exception of our heavy haul and suburban lines, they are used far more intensively.

For China's is a coal-based economy serving over a billion people. Coal has massive implications for the railways; over 40% of the tonnage is coal and another 12% comprises construction minerals.

China Railways uplifted 1,210 million tonnes in 1984 at a rate of 66,000 car-loads per day.

This was 48% of the national freight tonnage, but 71% of the transport task (i.e. tonne-km).

For the average rail haul in China is nearly 600 km, and this applies even though China is not well-endowed with rural roads, and the railways still handle many small consignment and short-haul tasks that trucks have done for decades in the West.

While these are to decline, all other traffics are planned to rise — and at massive rates. And many hauls in China are of Australian transcontinental length.

On the passenger side the intensity is equally high, lifting 1,123 million people annually over an average journey of 182 km. This is 54% of the national passenger-movement task, even though there is little suburban traffic in China as Australians would understand it.

Over three million people work on and directly for, China's railways.

As a result, the average traffic density per kilometre of track is 19 million gross tonnes, some five times that of a typical Australian intercity link like Sydney/Melbourne.

The key links in Eastern and Northern China that are not double track already are being doubled, and in many cases electrified as well.

Mission visits China

The Chengdu/Kunming Railway in South West China has some spectacular mountain railway engineering. The picture above shows four levels of track and further down the valley, but out of view, are three more river crossings. As a result of this heavy engineering, the ruling grade here is a notably easy 1 in 90 despite the mountainous terrain.

Equipment Seen

While a lot of this traffic is still handled by a fleet of over 7,500 big steam locomotives — still being built, and some 70% of the national fleet of 11,000 locomotives — the Australians and their cameras saw few steamers on main line trains.

The group also saw few of China's 25kV ac electrics, for the traffic in the Beijing and Nanjing areas, on the main trunk line between them, and on the spectacular mountain railway from Chengdu to Kunming in the south-west, is taken by diesel locomotives.

Diesel-electrics seen on line and under repair ranged from current Chinese and imported American GE units of 2,900kW, back to 1953-model Chinese units of 1,350kW, with interesting 10-cylinder opposed-piston 2-cycle engines having no valves.

There are also many diesel-hydraulic locomotives in use.

The group was shown the BJ class under construction at the 7 February works in Beijing, with manufacture right down to the engine parts and transmission turbine blading.

The party was later taken out of Beijing by one of these compact 92t 2,000kW units, which made light work of the 19-car, 900t Foochow Express on a schedule with a booked average of 81 km/h.

Chinese locomotive operation and maintenance practices observed included negligible use of diesels in multiple unit (except back-to-back, in married pairs); mixed diesel-electric and diesel-hydraulic traction with a crew on each engine; and non-pool use of diesel locomotives only within the frontiers of the owning Division, manned by one of five nominated crews.

Utilisation of the older units is about 100,000 km annually to a five-year major haul at 0.5m km, which task takes about three weeks in shops. The shops are often the original building "factory."

The 420 new GEs have not yet come up to full overhaul, and were seen taking (among other regional tasks) virtually all of the North/South freight through Nanjing, for which duties Nanjing depot is allocated 150 units and a total crewing, running and maintenance staff of 2,000 people.

Limited inquiries suggest that annual km on the GEs is not much higher than for the older diesels; it seems that the Chinese face a problem changing their old operating practices that discourage fuller utilisation of modern equipment.

The passenger cars seen uniformly comprised welded all-steel, ribbed-side stock, similar to Russian coaches. The Chinese plan to build lighter, more modern equipment less prone to corrosion.

Passenger trains in China are exceptionally crowded and there is no such thing as an empty berth.

Few cars are airconditioned. Stock is kept quite clean — especially when

he dust problem of open windows is borne in mind. Restaurant cars were clean and offered tasty Chinese fare.

Freight

Freight traffic operations were examined at Fengxi marshalling yard outside Beijing which has a claimed throughput of 20,000 wagons daily — 14,000 relayed and 6,000 humped. The yard, which is the test bed for some automation, is operated along traditional lines by a work force of over 1,000.

There is a high degree of reliance on the tower operator skill in switching and retarder operation.

Most Chinese freight traffic is still moved — block coal trans apart — substantially on a wagonload basis, rough classic marshalling yards. No intermodal traffic was seen except for a few containers.

The typical Chinese freight train is up to 50 cars for 3,000t but 100-car 10,000t coal trains will operate on the dedicated "Daquin" heavy haul line under electric traction.

There were over 290,000 freight cars in China in 1984 — no less than 62% of them being bogie highsides (gondolas) with box cars, tankers, flats, and reefers making up the balance.

The negligible use of hopper cars (none was seen, even in coal traffic) is due to manual materials-handling methods and problems of the coal freezing solid for winter.

The Chinese are looking at rotary unloading, not bottom dump.

The flexibility of the open gondola gon is also attractive to the Chinese; it was seen carrying a very wide variety of loads, sheeted and otherwise.

The mission saw few of China's legendary steam engines (70 per cent of the locomotive fleet). This old 2-8-2 was on a transfer freight at Chengdu.

A very high proportion of Chinese wagon bodies remain timber-planked. Many wagons have archbar (diamond frame) bogies, most seen had plain bearings and none — even new wagons — had modern diaphragm-type air brake equipment.

Maintenance demands are clearly very heavy, and include daily wagon examinations, but the work must be well done.

For the Chinese reliably operate plain-bearing archbar-truck cars at speeds up to 80 km/h, on routes such as that through Nanjing where freight trains follow each other every 15 minutes, 7 days a week.

At this density of traffic any rash of wagon defects would soon lead to chaotic traffic conditions on the line.

Infrastructure

The track in China is of very high standard indeed, over 60% of the lines having heavy rail (50 kg/m or above) and concrete sleepers.

The proportion of continuous welded rail, however, is low at only 17%, and while there has been much published evidence of panel track handling techniques in use, the level of mechanisation in maintenance is very low.

The Chinese are compulsive railway builders, with 22 percent of China's railwaymen involved in capital construction.

China's record of railway construction achievement is outstanding, and the Australian group was shown an interesting selection of skills.

This included advanced tunnelling, in hard and soft grounds, high earthworks, and bridge construction north of Beijing on the new "Daquin" coal line (Datong/Qinhuandao Port).

Presumably to conserve arable land, the Chinese tunnel and bridge in locations where Australians would cut and fill. The famous 2-deck Nanjing Bridge over the Yangtze River was inspected; its total (rail) structure length is 6.7 km, with 1.6 km over the river in 10 spans whose steel weighs twice that in the main arch of the Sydney Harbour Bridge Arch.

The world-famous Chengdu/Kunming line is described later.

While the group saw 25 kV ac wires up in the Beijing area (in one case, over only one track of a double-track line) and at the Chengdu end of the Baoji/Chengdu line in Sichuan, there

(continued on page 26)

Two GE Type C36-7 diesel locomotives at Nanjing Diesel Depot. Of the 400 units in these classes (later model on left) 150 are stationed at Nanjing.

Westrail moves a

At 1:20am on January 12 one of the biggest narrow gauge grain trains ever to run in WA set out from Forrestfield — 30 wagons pulled by double-header DA Locomotives.

By 11am, seven such trains were in motion, and so was the new Grand Grain Plan.

At its simplest, the plan means flooding a few selected loading points with wagons until all the grain is cleared out then moving onto other loading points.

The heaviest trains possible are used.

The result is a new leap forward in efficiency through fewer train journeys and wagon movements, a reduced crewing requirement and a much more uniform operating pattern.

This year the plan will save $1.4 million for Westrail.

But in time, the annual saving will reach $7 million.

The plan makes use of all the productivity gains already achieved through two-man crewing, use of bottom dump wagons, fleeting of trains and other initiatives.

It adds further gains from the use of double-header trains and soon, train orders instead of electric staffs and staff ticket safeworking methods currently used.

The Grand Grain Plan originated from demands by farmers for cheaper freight rates this season.

Westrail proposed to CBH a co-operative work arrangement intended to get the most from our trains and from the CBH facilities. Basically the proposal was for round-the-clock working.

That original proposal had to be modified because it would have affected CBH too much with extra labour, lighting and other costs.

The final compromise plan was therefore pieced together, creating a saving for farmers of $2.65 million on this harvest's freight charges.

CBH's key contribution has been the greater storage capacity in country bins provided for the record season two years ago.

This has virtually eliminated the great harvest peak that has dominated our railway for decades.

Now, there can be a steady 100,000 tonnes a week moving to port for the next 44 weeks.

That itself is a great gain.

More importantly, CBH has allowed Westrail to load at only 22 bins at any time, compared with the usual 40.

They have also increased the speed of loading by using two front-end loaders at each bin. The loaders are used to move the grain from the storage pile to conveyor belts.

The new working is already bringing enormous savings. Wagons used for the grain haul are down from 1210 to 780.

The number of older-style wooden wagons has fallen from 630 to 240.

Locomotives used on the grain task have fallen from 43 to 36 and crews from 90 to 74.

Other branches are sharing the benefits. Motive Power staff have a reduced maintenance demand, and civil engineers have much better access to track because traffic is regularly absent from branch lines for extended periods.

However, launch of the plan has not been without set-backs.

The introduction of double-header grain trains coincided with a spate of derailments that are thought to be heat-induced.

As a result of this set-back, a revised schedule of permissible speeds was issued for the double-headers, slowing them by 10km/h.

How the plan works

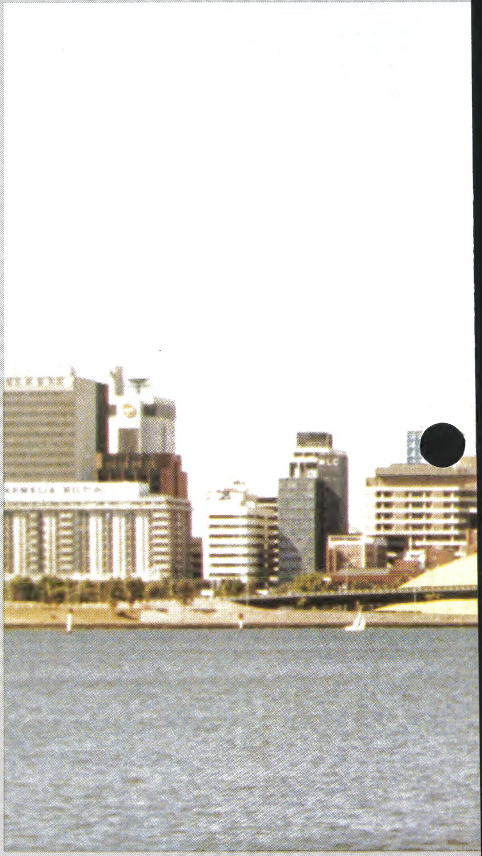
In the week commencing January 12, the neighbouring sidings of Kondinin and Bendering were among the first to be hauled from, using the Grand Grain Plan.

Two double-header trains dropped half their wagons at Bendering and the rest at Kondinin. New, faster loading methods allowed 1600 tonnes a day to be loaded at each site (1000 more than usual), and next day the identical happened again.

In 20 days the bins were emptied and the process moved elsewhere.

In that week only 20 train journeys were made in the West Merredin lines (Shackelton, Corrigin, Kondinin, Wyalkatchem) compared with the usual 43, yet roughly the same quantity of grain was moved.

In other developments the system of controlling trains, known as train



orders, is about to come to Westrail.

It will mean the beginning of the end for the system of train staffs, the standard method of safeworking on single tracks for over 100 years.

Train orders will do away with the nee[d] for train crews to stop and collect staffs at the beginning of each section of track.

Instead, the crews will receive instructions that are good for entire journeys including crossing of other trains.

The changeover to the new system will be made gradually. It is proposed to introduce train orders early next year in the lower South West between Picton Junction and Pemberton, including the branch lines to Wonnerup and Boyup Brook.

Orders will at first be passed to train crews "manually," either by telephone or by written instructions on standard forms.

The existing electric staff system between Picton Junction and Lambe[rt] will be withdrawn and the movemen[t] of all trains (and the larger Civil Engineering track machines) will be

mountain of grain

This year's harvest of 6.1 million tonnes could cover all of central Perth to a peak of 112 metres. Note: *The AMP building is 123m high.*

regulated by train orders issued by the Train Controllers at Picton.

Existing staff stations such as Kirup and Greenbushes will become Train Order Crossing Stations.

Stations such as Palgarup and Yornup, which do not have crossing facilities but do have telephone communications with Picton Control, will become Train Order Non-Crossing Stations.

The long-awaited change to train orders has allowed alterations to the Safeworking Rule Book to be made and training of staff to begin. New trackside signage is also being produced.

Operationally, the change has been made possible by the decline in the number of train crossings, the increase in the length of sections and therefore the decline in the need for retaining and maintaining the existing staff equipment.

The benefits of train orders will be felt immediately. The new high-capacity wagons worked in unit trains will be operated much more efficiently, with fewer costly stops and faster turnaround.

However, the full potential for train orders will be seen when radio communications are improved to allow instructions to be passed to train crews on the move.

A complete Great Southern radio network based on microwave links to wayside stations is now being evaluated, and could form the basis for this ultimate development of train orders.

The system of train orders allows up to about 10 trains a day to be worked on a single track railway, so it is ideal for much of the Westrail system.

Computerised Passenger Bookings

Meanwhile, in December last year Westrail's new Computerised Intrastate Booking System went "live" and brought to an end the old time consuming manual system of passenger bookings.

Passengers will now receive a much smoother start to their journey with the easier booking system.

The new system known as Traveline, has been developed entirely by Westrail and will provide an instant response to passenger enquiries and eliminate the delays which occurred under the old system.

Peter Hatton, Project Manager for the new system, said that the booking clerks would now be able to confirm each reservation immediately, at the terminal in their office, rather than having to ring through to the Westrail Reservation Centre in Perth with each individual enquiry.

Because Traveline is compatible with other programmes on Westrail's central computer, it will be possible during peak booking periods to transfer calls to operators at other than booking office terminals and so minimise delays to our clients, he said.

Mr Hatton said that as well as reservations, the new system is being further developed to incorporate instant timetable and fare recall and also allow for accurate extraction of data for control of rollingstock, road coaches and patronage levels.

Terminals have been installed in all country and metropolitan booking offices.

Rail manufacturing survey

Much of the railway hardware used by Australian railway Systems is supplied by private manufacturers.
Commodities supplied include locomotives, wagon, rail, sleepers and signalling equipment.
The private rail manufacturers in Australia therefore have a vital role to play in enabling cost-effective railway transport to be supplied.
As well significant exports of railway products are also at times generated by the railway manufacturing sector.
Starting in late 1984 the National Committee on Railway Engineering of the Institution of Engineers, Australia set as one of its major initiatives the examination of the manufacturing sector supplying products to the railway systems.
While many industry groups exist there is no common body representing all manufacturers of railway products which is capable of monitoring those manufacturers' specific concerns, and it was felt the National Committee could contribute by providing a picture of where the railway manufacturing sector stands today.
As little consolidated information was available a survey of manufacturers was undertaken in November 1985 and a report has now been prepared detailing the results of this survey.
Particular aspects addressed in the report are the geographical spread of suppliers, the amount of research and development undertaken and the export orientation of companies.

Description of Suppliers

The largest suppliers dominate sales to railways with the nine largest suppliers accounting for 68% of sales and the other 49 respondents 32%.
On average, of the firms surveyed, 70.6% of their railway product sales were directly to railway systems.
While most firms also sell to other industry sectors, 20 of the 55 respondents made over 30% of their sales to railway systems, which indicates there would be a significant number of firms which could be seriously affected by either changes in railway purchasing policy or in total railway system demand.

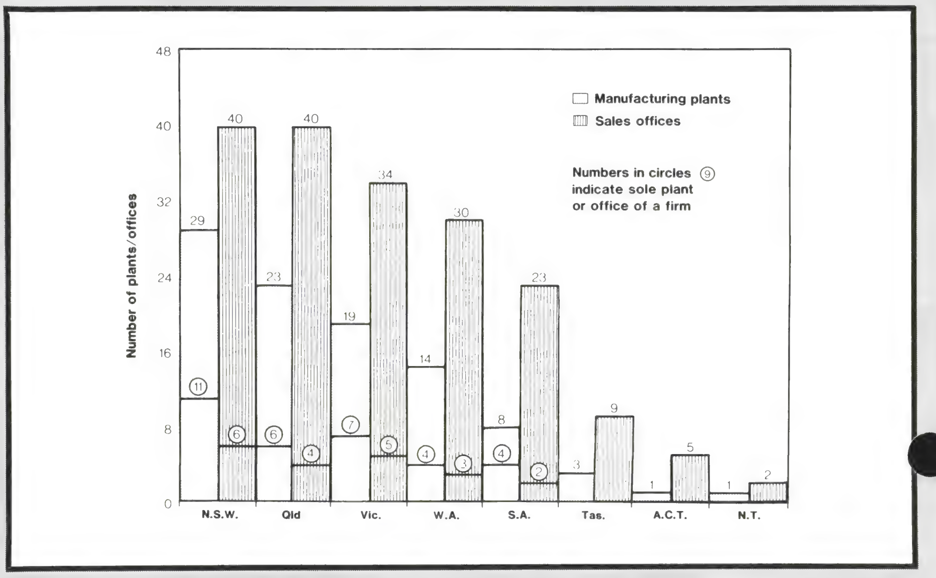


Fig. 1: Distribution of Manufacturing Plants/Sales Offices of Firms Surveyed.

Firms totally dependent on railway sales (9 firms greater than 90% of sales to railway systems) have a greater export orientation and export success rate.
The geographical location of manufacturing plants and sales offices (see Fig 1.) was in line with the relative size of the railway system located in each state. In rank order, by state: NSW, QLD, VIC, WA, SA
Few plants are located in the territories and Tasmania. Over half of the firms surveyed operated only one manufacturing plant, i.e., manufacture was in one state only.
On average, firms operated 1.6 plants and 3.1 sales offices with larger firms being more geographically diverse.
Thirty-eight per cent of firms had foreign ownership greater than 50%.

Sales Position

Of the firms replying to this part of the survey 50% (54) were experiencing increasing sales while only 10 had more products with decreasing sales than increasing sales.
Smaller firms which had not introduced new products tended to perform poorly. Of the 10 firms with no new products 7 (70%) had decreasing or stable sales.
The ten firms which were experiencing decreasing sales were mainly (7) manufacturers of steel or metallic products (the remaining 3 were foreign owned). These companies were also less likely to have introduced new products and spent on average less than half (in percentage terms) of what other firms spent on research and development.

Exports and Imports

The majority of firms in the survey had attempted to enter the export market.
As shown in Fig. 2 larger firms not only are more likely to have tried to export, but have been more successful.
Exporting firms with one exception were not importers of products with greater than 50% overseas content.
In general Australian-owned firms had a much greater likelihood of being successful exporters than firms with a foreign ownership of greater than 50%.
It was apparent that it was an almost essential qualification to have developed and introduced new railway products to be a successful exporter.
Based on this result it is apparent that not only will spending on research and development by companies assist in improving the productivity of Australian railway systems, but that this expenditure will have implications for Australian exports.
Some joint federal/state funding of railway product research and

'Nine largest firms account for 68% of sa

a spotlight on suppliers

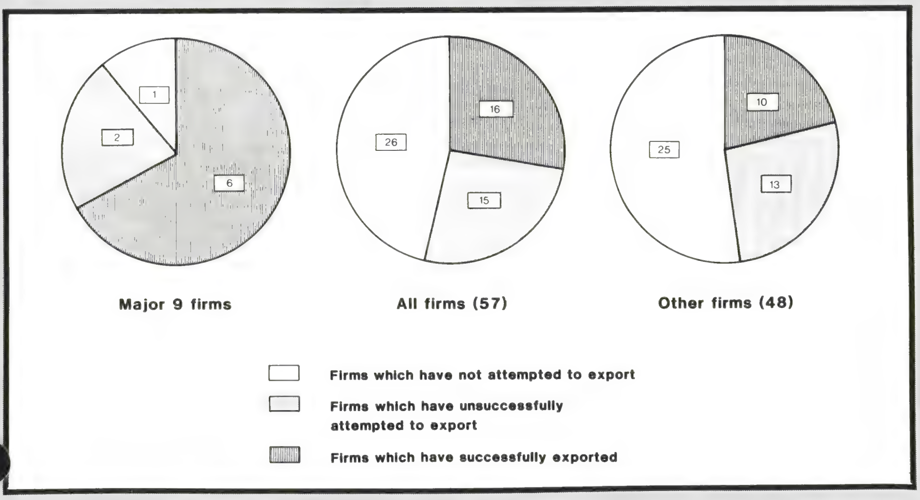


Fig. 2: Export Propensity and Success of Major Firms.

development may therefore be warranted.

14 (of 57 respondees) imported more than one of their products (greater than 50% of production cost outside Australia). 11 of the 14 importing firms were foreign owned and these firms imported 33 of 37 imported railway products.

Research

The following percentages expenditure on R & D were obtained: All firms: 1.8% of their railway sales; Major firms: 1.0% of their railway sales; Smaller firms: 3.5% of their railway sales.

As illustrated in Fig. 3 *smaller firms contribute significantly more, in total to railway related R & D than the major firms despite having significantly less of the market.*

As well it should be recognised that the expenditure by railways on research and development is significantly smaller in percentage terms with values of 0.5% (Pilbara railways) and 0.1% (government railways) having been previously estimated by I.E. Aust. Based on these figures *it may be concluded that private companies have been spending greater amounts on product development than railway systems have been spending on research,* although this has been increasingly recently.

The percentage of railway sales spent on research and development varies markedly between firms.

For instance in the 'smaller firms category' six firms spend in excess of $100,000 per annum and account for 63% of R & D expenditure, which incidentally is more than that spent by the nine 'major' firms (38%).

Four of these companies produce components/systems with a significant electronic content and significantly five of the six companies predominantly use Australian based engineering and design services.

Railways Receptive to New Ideas

The general 'public' perception of railways and railway engineering in Australia is not a positive one, with significant criticisms of railway performance being common in the media of some states.

Firms dealing with railway systems, however, have a significantly different and positive impression.

In answer to the question, 'If you approach a railway System in Australia are they in general receptive to new ideas/products?', *54 firms responded with 40 considering the railways helpful* and 14 having a less satisfactory impression.

Improved Manufacturing Performance Possible

As part of the survey manufacturers were asked what were their problems in dealing with railways. The four most important factors mentioned were:

- Market Size/Planning. The limited and fluctuating market combined with lack of knowledge of forward plans is perceived by manufacturers as the major constraint.
- Tendering/Project Acceptance, Payment and Development Periods. Companies perceive that railways act slowly.
- Railway Attitudes/Organisation. Railway systems are perceived as too bureaucratic and too slow to change/adapt.
- Access/Communication with Railway Personnel.

It must be stressed here that these problems' should be seen in the context of the positive attitudes that suppliers feel railways show to new product/ideas.

However, if improvements can be made in these areas they are likely to be of benefit not only to manufacturers but to the railway industry as a whole.

Copies of the report are available from the Institution of Engineers, Australia, 11 National Circuit, Barton, ACT, at a cost of $6.00.

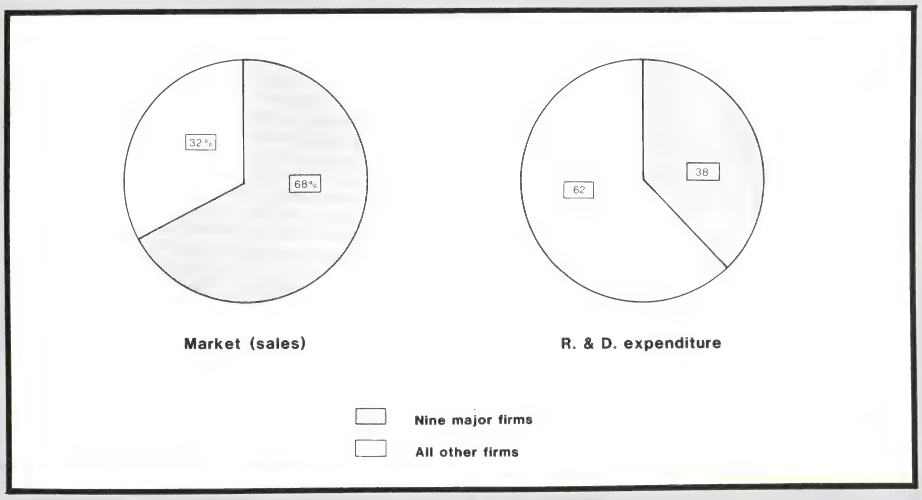


Fig. 3: Comparison of Market Share and R. & D. Expenditures of Firms by Size.

es for railways'

New fast train for Westrail

A new fast train for WA is now taking shape. The Minister for Transport Gavan Troy recently showed off progress of the new train at the Comeng factory (WA) in Bassendean. The $7 million 110km/h express will replace the Australind on the Perth-Bunbury run mid-1987, cutting time for the 185km journey from 3-25 hours to 2 hours.

"The South-West and Bunbury stand to benefit greatly from having a fast rail link to Perth," Mr. Troy said.

"This train will also bring significant benefits to towns along the way, such as Pinjarra and Harvey.

"I can foresee people commuting for business in Perth from the South-West. And travellers will be lured to the tourism destinations by the attraction of a top-class train."

The new Bunbury train will consist of five stainless steel self-propelled cars, similar in style to the successful Prospector train.

The train is extremely adaptable and is able to run as a two, three, four or five car set.

"Passenger facilities are the very latest and should attract people to the new train," Mr. Troy said.

The seats will rotate and recline and the windows will be tinted and double-glazed.

The train's top speed of 110km/h has been made possible by a $24 million project to upgrade the South-West mainline between Perth and Bunbury. The project, intended to benefit freight trains principally, will be finished mid-year in time for the first run of the high-speed passenger train.

The train will make two return journeys each day except Sunday.

"We are developing the timetable in consultation with local communities and in co-ordination with Westrail's road coach services beyond Bunbury," Mr. Troy said.

Two of the cars will seat 60 passengers. The other three will have seats for 40 passengers, but also have a driver's compartment, a galley and a wheelchair area.

Each car will be driven by a 6-cylinder [illegible]-litre turbocharged diesel engine and have a separate 8.2-litre V8 auxiliary engine for air conditioning and other services.

TECHNICAL INFORMATION

Number of cars:	Five (3 driving, 2 non-driving)	
Construction:	Stainless steel monocoque	
Length:	20.2m	
Width:	2.88m	
Gauge of track:	1067mm	
Power:	Traction engine — Cummins diesel of 372kw continuous power rating, mounted underfloor. Auxiliary power — GM Detroit V8 diesel coupled to 70kVA alternator.	
Crew:	Driver, guard and 1 stewardess per driving car.	
Features:	**Driving Cars**	**Non-Driving Cars**
	Galley	—
	Wheelchair area	—
	Toilet	Toilet
	Curtained area for nursing mothers	Curtained area for nursing mothers
	Luggage alcove	Luggage/bike alcove

Brisbane's metro-electri

Brisbane electric train set near the $75 million Brisbane Transit Centre at Roma Street.

The highly successful electrification of the Brisbane suburban rail system is nearing completion at a cost of $400 million.
The opening of the Wellington Point-Cleveland extension in the south-eastern dormitory of Redland Shire and the electrification of the Eagle Junction-Airport northside branch late last year will complete the electrification of the metropolitan rail network.
The modernization of Brisbane's rail system has been a major success. Patronage has increased by 60 per cent since the introduction of electric trains on the Ferny Grove-Darra corridor in November 1979.
Passenger numbers totalled a record 40.2 million in 1985-86, and early figures for this financial year indicate a further gain of nearly five per cent.
Planning is underway for a $100 million expansion of Brisbane's inner-city rail network because of the passenger boom.
The project includes the duplication of rail tunnels between Roma Street, Central, and Brunswick Street stations and the provision of a fourth track between Bowen Hills and Brunswick Street.
Queensland Railways predicts duplication of the tunnels will be necessary by the early 1990's.
Peak hour already is a major problem in the inner-city tunnels and hampering expansion of services.
Provision of four tracks between Roma Street and Bowen Hills will increase the capacity of the inner-city system by 60 per cent and will permit a more flexible response to any difficulties and delays in train operations.
The huge swing to electric train travel in the rapidly-growing areas on the suburban periphery substantiates the

Electric car interior featuring wide tinted windows and carpet.

ication almost complete

need for an expansion of the inner-city tunnels.
Patronage from the northern dormitory area of Caboolture, for example, has increased almost 90% in the 12 months to November, 1986 following electrification of the Petrie-Caboolture corridor.
In addition commuter numbers from Redland Shire have increased 33 per cent in the same period since the extension of the new electrified railway from Thorneside to Birkdale and Wellington Point.
Public support for the electric trains has exceeded the expectations of the Queensland Government, which had in 1974 opted for faster electric rail services as the nucleus of the city's public transport in the 1980's and beyond.
Central to the provision of modern electric trains for Brisbane's one million residents was the completion of the cross-river rail link, the Merivale Bridge, in November, 1978.
The bridge joined the southern and northern suburban systems, allowing patrons direct access to all lines.
Electric trains entered regular service in November 1979 on the 32km section between Ferny Grove and Darra.
Further extensions have seen the network grow to 180 route kilometres.
Additions have been Darra-Ipswich (1980); Shorncliffe-Kingston (1982); Northgate-Beenleigh (1984); Petrie-Caboolture and Thorneside-Wellington Point (1986).

The new Wellington Point station.

A key factor in the success of the electrification programme has been the strong public acceptance of the rolling stock for the metropolitan network.
Walkers-ASEA Pty Ltd of Maryborough Queensland recently completed the Queensland Railways' order for 264 cars at a cost of nearly $210 million.

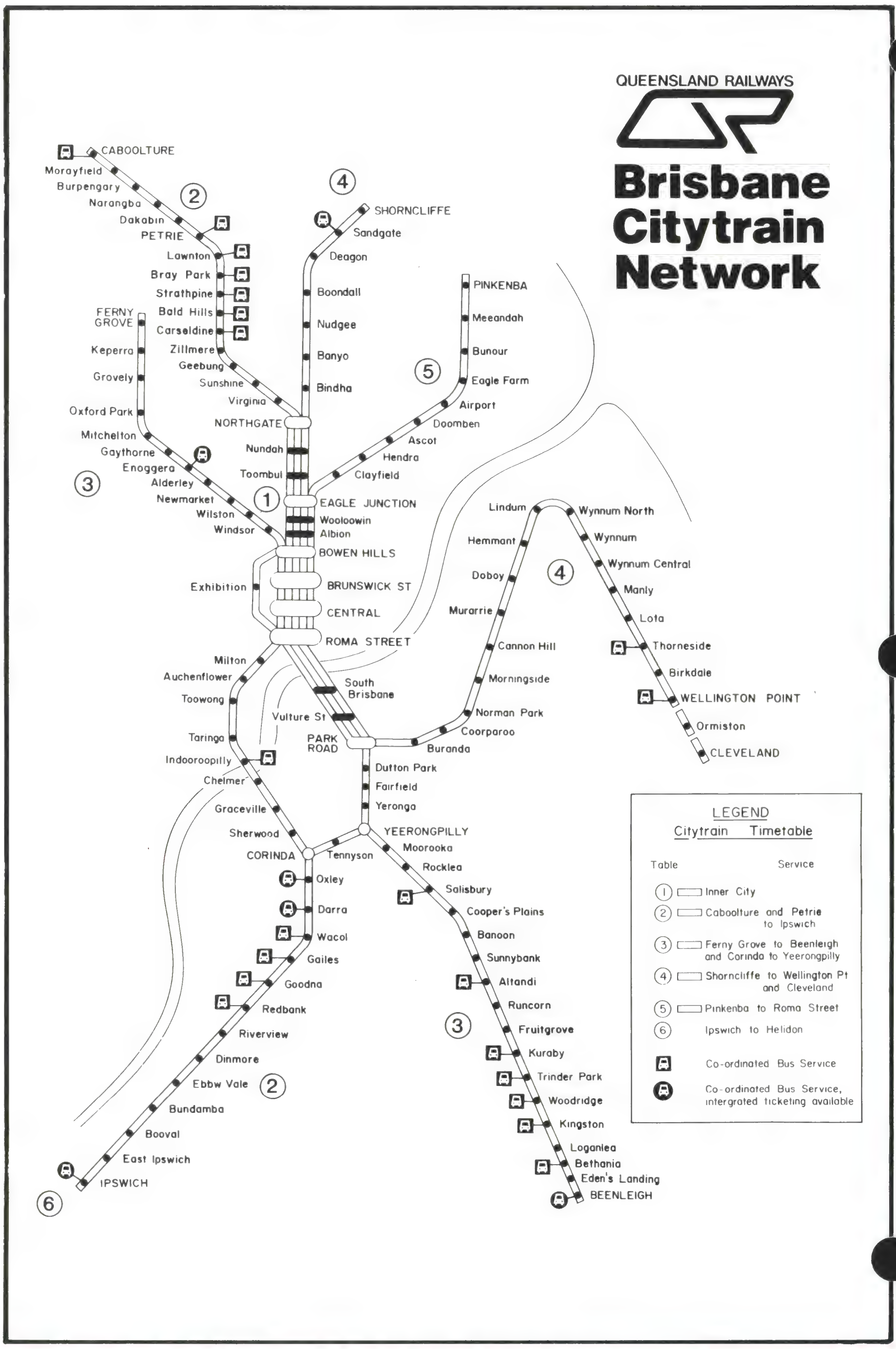
Toowong station, modernised in conjunction with the $120 million Toowong Village Airspace development.

All major items of electrical equipment were manufactured in Sweden by ASEA and the cars were constructed at Walkers' Workshops, 270km north of Brisbane.
Operable as three or six unit trains, the cars are the first fully air-conditioned suburban carriages to be introduced in Australia, and the first to be powered by a high-voltage 25,000 volt overhead system of wiring.
Other features include tinted windows, carpet in the seating section and woollen seat covers.
Seating is provided for 248 passengers in the 3-car electric multiple units with a total crush load capacity of approximately 500 passengers possible.
The stainless steel cars are 23 metres long.
A maximum speed of 100km per hour and faster acceleration between stations has allowed reductions of up to 25% in journey times compared with diesel traction.
All off-peak and most peak-hour services on the major corridors are electric but these are supplemented by diesel-hauled stainless steel trains and rail cars.
More electric cars are likely to be needed in the future, given the continuing growth in passenger numbers.
Apart from the world-class standard of the electric rolling stock on Brisbane's

suburban lines, greatly improved access to rail stations has played a significant role in the growing popularity of the rail mode.
The provision of bus/rail interchanges at 28 stations on the suburban network and the construction of 8,500 car parking bays at stations have substantially improved accessibility of electric trains.
Major air-space developments also are generating improved patronage on the rail systems. These have been undertaken concurrently with the rail electrification and modernization programme.
About $850 million worth of projects have recently been completed, are under construction, or planned. These include the $120 million Toowong Village in the western suburbs and the $75 million Brisbane Transit Centre at Roma Street.
The Toowong Village, 4.5km from Central, comprises a new station; car parking for 1600 vehicles; three levels of retailing; and an office tower of 17,000 square metres gross floor area.
The Transit Centre is Australia's largest and most modern transport facility catering for all interstate, and suburban rail passengers and inter and intra-state coach travellers.
Included are retail facilities; two office towers; Brisbane City Travelodge Hotel; coach terminal and car parking for 580 vehicles.
The $120 million Ipswich City Square redevelopment of the heart of Ipswich by Kern Corporation Ltd is currently well advanced and includes development of air space over the railway, major refurbishment of the station and a new transport interchange.
The redevelopment covers the major portion of four city blocks and involves a new mall in Nicholas Street and construction of a new ring road system.
Completion is expected by late 1987.
Meanwhile electric trains will serve the Sunshine Coast, one of Australia's fastest growing areas, from next year.
Brisbane and Nambour, 105 km north of the Queensland capital, will be linked in 90 minutes by inter-urban trains travelling at speeds of up to 120km per hour.
The new trains will be built by Walkers-ASEA Pty Ltd Maryborough, at a cost of $23.5 million.
Walkers has been contracted to build six 2-car sets of a driver motor and motor car and two pairs of non-motored trailer cars.

> 'Public support for the electric trains has exceeded all expectations of the Queensland Government'

The 16 units will carry passengers from Nambour to Brisbane for Expo 88 and are expected to be in service between Rockhampton and Brisbane by September, 1989, when Stage four of Main Line Electrification is scheduled for completion.
The Brisbane to Nambour link is an important spin-off from the $362 million Stage 4 of Main Line Electrification between Caboolture, north of Brisbane and Rockhampton.
It will extend electrification 53km north from Caboolture, the northern terminus of the Brisbane suburban system at a cost of $40 million.
The Caboolture-Nambour section is expected to be energised in March, 1988.



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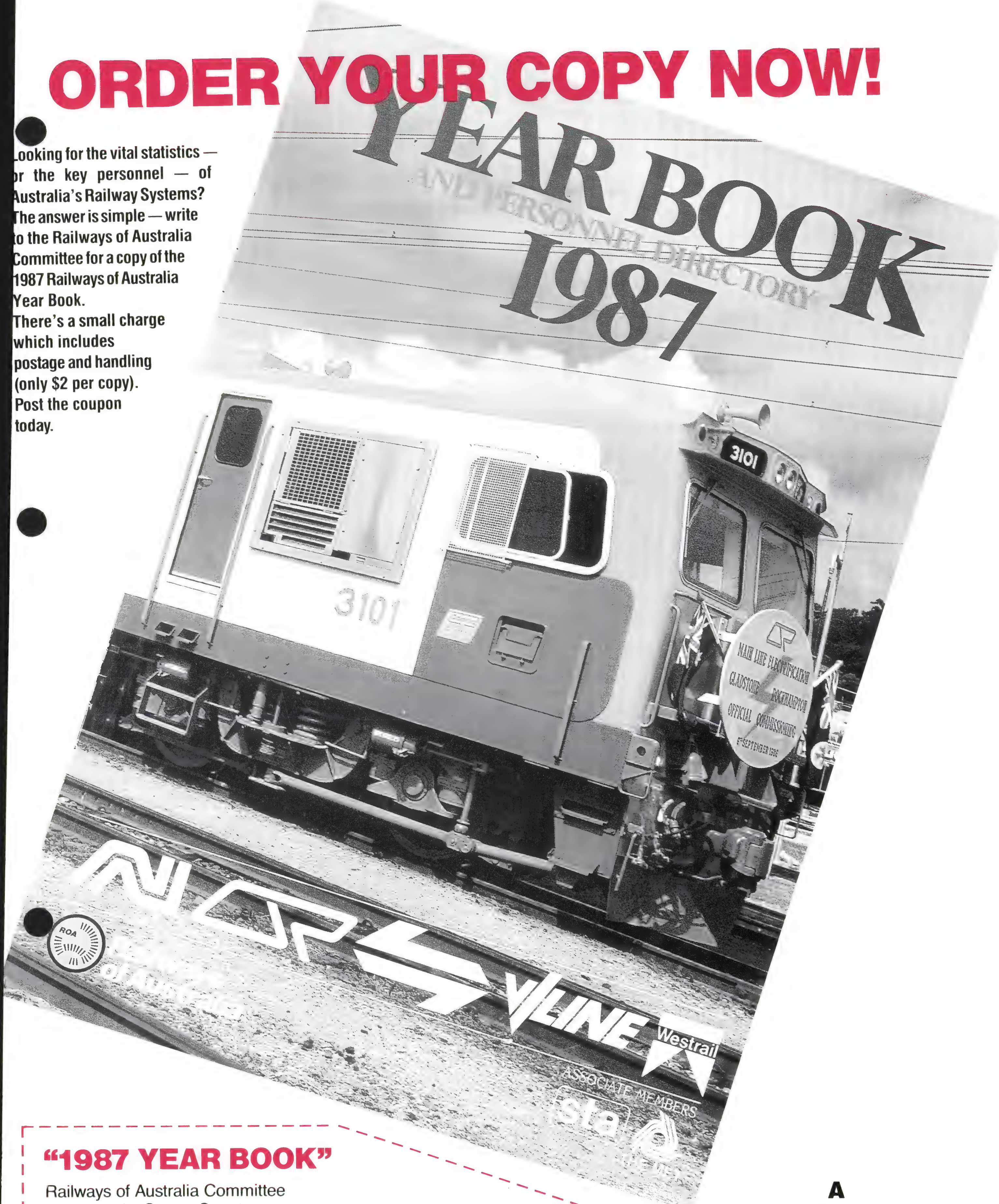

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NMIT is New Zealand

By Roy Sinclair

Most railway systems have a "best kept secret."

In New Zealand it is the Silver Fern railcar service that runs over the 681 km North Island Main Trunk (NIMT) between Wellington and Auckland.

The railcars presently run five days of the week — Monday to Friday — and the service is one New Zealand Railways have every right to be proud of.

Throughout the journey there is an informative commentary, morning and afternoon refreshments are provided and there is a bar service.

The Silver Fern is often described as a "tour bus on rails."

Until recent years most NIMT journeys were made at night on a notorious train known as the "Limited."

Daylight travel on this scenic route was confined to a few weeks around Christmas until in 1972 when the Silver Fern service was introduced after successful trials with other railcars.

New Zealand has been symbolised by a silver fern for more than a century.

"Silver Fern" is therefore a logical name for the service run by the three railcars, externally finished with ribbed stainless-steel, that were supplied by the Nissho-Iwa Company of Japan.

Each railcar consists of two permanently coupled coaches mounted on four bogies.

In the sound-insulated engine compartment a Caterpillar D398TA, 670kW diesel engine drives a direct-coupled alternator.

The power from the alternator is converted to direct-current and supplied to four 148kW electric traction motors, two of which are mounted on each of the outer bogies.

The railcars seat 96 passengers and being fully airconditioned, they provide the highest standard of comfort currently available on New Zealand's railways.

Last October I made my first trip to the North Island for some time.

I had not travelled on the Silver Fern and I was interested to see the work being done on the NIMT electrification. It was therefore with some anticipation that I boarded the railcar in Wellington.

A railway journey out of the capital city on a fine morning is a pleasant experience.

One of the Siver Fern railcars leaving Auckland at the start of another 681 km 11 hour journey to Wellington. — Roy Sinclair.

For several minutes the railcar skirted around Wellington's magnificent harbour before going through the two long Tawa tunnels which put almost 6 km of the railway underground.

Soon we were running beside the sea again, this time on the western coast of the North Island.

By now the stewardess was talking to us about Wellington's outer suburbs that were being left behind and pointing out Kapiti Island standing a few kilometres off the coast.

The Silver Fern is ideally suited to overseas visitors.

Australians, in particular, find it a fascinating journey that is vastly different to any railway journey at home. One Australian who recently enjoyed the trip was Bernie Schultz from the Auckland office of the Australian Tourist Commission.

The original railway north of Wellington was built by the Wellington and Manawatu Railway Company which was founded by Wellington businessmen.

The 135km railway ran as far as Longburn (near Palmerston North) where it joined the Government-owned Taranaki line to New Plymouth.

The Government had rejected plans to built a railway through the Manawatu and even refused to have anything to do with it when it was completed in 1886.

The company ran the railway until 1908 when it was taken over by the Government as the southern section of the NIMT.

One admirer of the Wellington and Manawatu Railway was the Australasian writer and poet, Will Lawson, who died in Sydney in 1957.

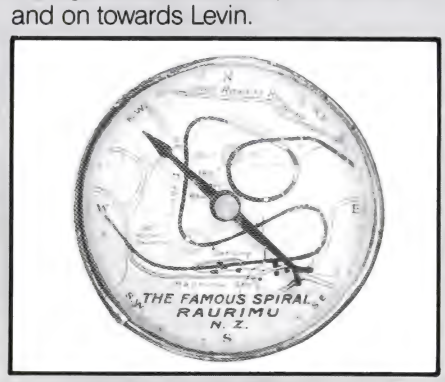
His favourite train was the New Plymouth Mail, especially when it was hauled by one of the Baldwin 4-6-0s.

He enjoyed riding on locomotives and his experiences on the Wellington and Manawatu Railway inspired much of his railway verse, including these lines from "Firing on the Mail."

"So I lean my burnin' brow
Up against the gale,
'Way up north of Manakau
Firin' on the Mail.
Hear the drivers down below
Singing on the rail —
Fifty-seven miles we go,
Firin' on the Mail."

I have read most of Will Lawson's railway poems and many of his novels. One, "Galloping Wheels," is a railway story set in New South Wales.

I was thinking about Will Lawson as the Silver Fern skimmed effortlessly through the Manawatu; past Manakau and on towards Levin.



During the early Main Trunk journeys passengers were sold a compass for 6d to enable them to follow their way around the Raurimu Spiral. The photograph of this interesting relic was supplied by "Roll Back the Years" of Taumarunui.

Rail's 'best kept secret'

The stewardess brought me back to the present when she offered me a cup of tea.

Palmerston North is the first main centre reached on the journey.

It is also the starting point for the new electrification which will stretch 410km through the central North Island to Te Rapa. As we left the town I was interested to see the installations which were almost completed.

In fact, it was a little strange travelling northwards under the wires and passing endless concrete poles without sighting any electric trains.

The electrification is the largest engineering project to be undertaken since the NIMT was opened in 1908.

Unfortunately, it has become the subject for much political debate.

Arguments, mostly unfounded, started in Parliament during 1986 and continued in newspapers under headings such as "Electric Main Trunk a Dud."

It was even suggested that the electrification may never be turned on.

There has been criticism of the tremendous cost involved, especially now that oil prices have fallen. Some politicians claim that the continued use of diesels would have been a better proposition.

There have also been arguments over how much should be paid for the electricity, an indigenous fuel which has a guaranteed future in New Zealand.

Critics have failed to mention any of the long-term advantages of electrification and they seem to be unaware that railways in many countries, including Australia, are installing electrification projects based on the same 25kV AC 50Hz overhead system that is about to go into operation in New Zealand. It is interesting to note that although the NIMT represents only about 15% of the NZR route length, it carries 40% of the country's total railway traffic.

As we travelled north through the Rangitikei and over the new 9km Mangaweka deviation with its three impressive concrete viaducts — the 81 metre high North Rangitikei is the highest viaduct on the NIMT — the tremendous cost of electrification was becoming apparent.

To make the electrification worthwhile, it was decided to rebuild much of the railway.

This work includes deviations, daylighting tunnels, strengthening viaducts to take the 18 tonne axle load of the 30 class locomotives, and easing curves.

The improved trackwork is making the going easier for existing locomotives and a pair of diesel-electrics are hauling loads that will soon be coupled behind a single 30 class electric.

However, it must be realised that improved diesel performance is a direct result of improvements that have been made for the electrification.

In 1950, the NZR General Manager, F.W. Aickin, had wanted to electrify the entire NIMT owing to the high cost of running steam locomotives but the plans which had been developed to an advance stage were abandoned in favour of diesel-electrics.

The present electrification was approved in June 1980 and is expected to be completed by mid-1988 in time for the 125th anniversary of the New Zealand Railways.

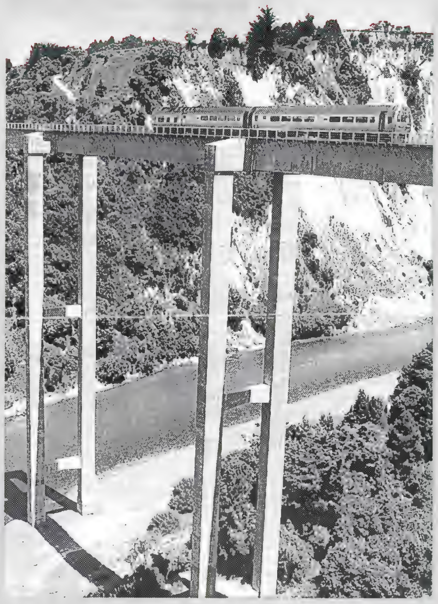
After a lunch break at Taihape, our Silver Fern railcar was climbing towards Waiouru which at 813 metres is the highest station in New Zealand.

From Waiouru, the NIMT crosses the desolate central plateau, the most rugged section of the railway.

The first train to travel between Wellington and Auckland made the journey on August 7, 1908. It was the Parliamentary Special carrying the Prime Minister, Sir Joseph Ward, his cabinet and guests, to meet the American "Great White Fleet" which was visiting Auckland.

To enable the special train to travel over the 50km between Waiouru and Erua — the last section of the NIMT to be completed — a temporary railway was laid. Cuttings were made just wide enough to allow a train to pass through and the track was only partially ballasted.

The journey on the Parliamentary Special was no picnic. The night had been intensely cold and by morning there were icicles hanging from the carriage ceilings.



The 81 metre high North Rangitikei is the highest viaduct on the NMIT.

On the temporary track, ice could be heart cracking as the train crawled along at a walking pace, shaking the whole foundation.

However, there were compensations: one of the passengers, T.E.Y. Seddon, Member for Westland (and son of former Prime Minister, Richard Seddon) later recalled the glorious sight that presented itself as the beams from the rising sun touched the snow-capped peaks of the volcanoes, Ruapehu, Ngauruhoe, and Tongariro. Today, the central North Island volcanoes can be viewed from the air-conditioned comfort provided by the Silver Fern railcars.

The NIMT passes through the Tongariro National Park which was one of the first three national parks in the world when it was established in 1887.

In this area, Silver Fern passengers have a grandstand view of the work being done on the Ohakune — Horopito deviation which includes replacing the massive steel Hapuawhenua Viaduct.

Nine routes were considered for the new railway and the final decision was made with the agreement of conservation groups, the Tongariro National Park, and the Commission for the Environment.

However, the section of the NIMT most travellers want to see is the Raurimu Spiral.

(continued on page 23)

bookshelf

Jane's World Railways

Jane's World Railways — 1986-87
Edited by Geoffrey Freeman Allen
Published in London by:

Jane's Publishing Company Limited
Price £70 stg

Editing a volume as authoritative as Jane's World Railways is a daunting challenge for any literary talent — and Geoffrey Freeman Allen has not only accepted the gauntlet, but also won a decisive victory over statistics and specifications in a volume of over 930 pages weighing in at almost 4kg.

As in previous volumes, the twenty eighth edition is a treatise on the world's Railway Systems, railway manufacturers, international railway associations and rapid transit and underground railways.

The Australian locomotive section is comprehensive. Clyde have detailed diesel locomotive production since 1975 in a most effective table; Comeng has seen the wisdom of submitting many more illustrations to Jane's and benefit accordingly. The Goninan contribution is disappointing and brief.

In the Railway Systems section, Australia is well represented with detailed reports from Australian National, the State Rail Authority of NSW, Queensland Railways, the State Transport Authority of SA, V/Line, MTA (Vic) and Westrail. Australian National, the SRA of NSW and Queensland Railways deserve a special mention. The V/Line material is also extensive, with every illustration displaying the latest livery; the details provided by Westrail concerning the diesel locomotive fleet are most commendable. In general, Railways of Australia can be proud of the total Australian listing.

Across the Tasman, the New Zealand Railways Corporation features well, with a detailed two and a half page entry.

However, Australia and New Zealand Systems should review the personnel lists quoted, as many names and titles are less than accurate.

Reviewing a publication of the nature of Jane's World Railways is a forbidding task. A final analysis can only state the publication is unique, and the most effective and informative volume available in the world today.

In just 11km, between National Park and Raurimu, the railway drops 215 metres over the edge of the huge Waimarino Plateau. The direct-line distance between the two stations is only 5.6km.
On the days I travelled over the spiral an excellent commentary was given by stewardess, Denise Barrow, from Auckland.
She explained every bend and told us which side of the railcar to look from to see where we had been and where we were going.
The Raurimu Spiral, designed by R.F. Holmes in 1899, has one complete spiral, three horseshoe bends and two tunnels.
It has an average grade of 1 in 52 but owing to the sharp curves, the grade is, in effect, 1 in 42.
Even today the spiral is considered to be one of the world's great railway engineering feats.
It is expected that a single 30 class electric will haul 1000 tonnes up the Raurimu Spiral. Currently, single Dx class diesel-electrics are hauling 720 tonnes between Raurimu and National Park.
Although I had seen numerous reports about the electrification, I was surprised by the progress that had been made.
By early this year electric locomotives should be working between Palmerston North and Taihape and by the end of the year they will be continuing onto Ohakune which is at the end of the first stage.
Our next stop was Taumarunui. During the construction of the NIMT, frontier towns were built that could have come straight out of the American West.
Taumarunui was, perhaps, the best example. Taumarunui of 1904 has been described by New Zealand writer, James Cowan in "Tales of the Maori" as a replica of the 1878 Dodge City in Kansas.
Cowan goes on to say that although the New Zealand town was not shot up regularly by cowboys, it did have a "casual indifference to the convention of Queen Street, Auckland."
As part of the electrification project, a new computer-assisted signalling system has been installed at Taumarunui. It is an improvement over the Centralised Traffic Control that previously monitored trains through the central North Island.
The new system at Taumarunui will control some 360km of railway between Marton and Hamilton and replace three existing CTC offices.

The old Hapuawhenau Viaduct is expected to be retained as a walkway and memorial to New Zealand's pioneer engineering. The sharp curvature meant that even if it was strengthened for the new 30-class electrics, it would still be subject to severe speed restrictions. — Mark Cole.

Much of the new signalling equipment was supplied by Westinghouse Systems, a subsidiary of the Westinghouse Brake and Signal Company of Melbourne.
An interesting feature on the NIMT between Taumarunui and Hamilton is the 1.3km Porootarao Tunnel. Completed in 1980, it is the newest tunnel on the NZR and it has a slab concrete track bed.
This type of track bed was introduced to New Zealand when the 8.85km Kaimai Tunnel was being constructed in the Bay of Plenty during the 1970s. There are still only a few examples of concrete track bed around the world.
Our Silver Fern left Hamilton in the early morning. Just north of the city we passed Te Rapa which will be the northern terminus for the electrification.
By then we were picking up speed for the remaining 128km to Auckland which is all double track — the longest section of double track on the NZR — and one of the few sections where longer distances can be run at 100km/h.
After a day in Auckland, I returned to Wellington on the southbound Silver Fern. During the journey I met Bill Davies, a Wellington steward who joined our service at National Park.
He was wearing an Australian XPT tie pin and I soon discovered that he had a vast knowledge of all the railways in Australasia.
After spending his working days on the Silver Fern he enjoys his holidays travelling the railways of Australia.
He gave a magnificent commentary as we travelled over the southern section of the NIMT.
I also met Paul Natham, a Silver Fern driver from Wellington who was travelling as a passenger. He also knew Australia's railways well and told me something about the friendly rivalry that exists between enginemen across the Tasman.
Travelling over the NIMT twice within three days left me feeling a little weary. On the return trip we ran more than an hour late owing to the derailment of a work train near Raurimu.
However, it was an experience I would not have missed. I have met people who have travelled across the world to ride on the Silver Fern.
I can now say that I have made the trip myself.

bookshelf

'Man of Steam'

By David Burke

280 pages, 130 photographs, hard bound, with colour dustjacket by Phil Belbin. RRP $27.95. Published by Iron Horse Press, Mosman, NSW.

This is the second of David Burke's essays on the lives of railwaymen who contributed signficantly to locomotive development in this country.

'Man of Steam' tells the story of Ernest Edward Lucy, who came from England to join the New South Wales Railways as Assistant Chief Mechanical Engineer in 1906, and retired as Chief Mechanical Engineer in 1932.

Those who have an interest in the development of Australia's railways and not just their locomotives, will find this book an absorbing story.

Mr Burke uses the life of Lucy as an ongoing thread to link the development of New South Wales Railways during his tenure of office. And a long tenure it was — 72 is hardly a fashionable retiring age these days!

In that time, the New South Wales rail system grew rapidly to become Australia's largest and busiest. On the latter count, it has only just been superseded.

Route mileage increased by 70%, total train miles more than doubled and passenger journeys grew by 250%. Interestingly, total freight tonnage grew by only 41%, demonstrating that growth took place in corridors where traffic would be expected to be light; earlier lines continued to produce the heavier traffic.

And they were exciting years, too. Lucy arrived when the famous Lithgow Zigzag was close to elimination, with the construction of the ten-tunnel deviation through the western slopes of the Blue Mountains.

And he retired shortly after the opening of Sydney's famous Harbour Bridge.

He saw, and was responsible for part of, the electrification of Sydney's suburban railways.

Australia's first underground railway opened in the same period.

Internally within the railway administration, there were significant changes — and the influence of politics on railway management is clearly demonstrated.

In his prime task, as Chief Mechanical Engineer, Lucy oversaw the development of five significant types of New South Wales steam locomotives.

PLANNED OBSOLESCENCE IS A THING OF THE PAST.

Once, not so long ago, some manufacturers' products were deliberately made with a very short life cycle. The idea was that they'd wear out. Be replaced. To wear out and be replaced yet again. High turnover, it was thought, meant high profits.

But times have changed. No longer can we afford to expend our energies and resources as if there was no tomorrow.

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Strategies BHPCPS486

The Chengdu-Kunming mail train. The 2000 hp 'East Wind 4' diesel locomotives are changed at divisional points and an extra diesel (often with a second crew unless marshalled back-to-back) is added for steeply graded sections. Locomotives are single-cab Co-Co units with Fairbanks Morse style opposed piston engines (10 cylinders), mechanical blowers and tyred wheels.

(continued from page 9)

was little exposure to China's 25kV ac electrification practice on this visit.

As the world's largest electrification programme is currently in hand and much has been written about it elsewhere, electrification can be expected to figure highly in future exchange visits to China, and vice-versa.

Certainly the Australian 25kV ac experience in central Queensland is of distinct relevance to China in operating her long unit coal trains.

Virtually all the signals seen in China were colour-lights. The visit to the Beijing Station showed us an electric signal box of fairly conservative design.

There is some CTC in China but conventional automatic block (single and double line) and manual block techniques are more commonly used.

Not one significant yard that was seen that lacked full electric interlocking and switch machines.

The group was shown a test installation of Chinese-made fibre optic communications equipment, and notes the extensive use of buried cable rather than open-wire telecommunications lines on other lines.

The Chinese signal engineers seemed surprised by the Australian inability to quote statistical percentages of type of equipment installed, number of stations equipped this way or that, etc, and Australians as future visitors and hosts could usefully bear this in mind.

Research

There is, within the scientific establishment in China, the Chinese Academy of Railway Sciences (CARS) comprising 10 specialist Institutes (8 in Beijing), 65 Divisions and over 4,000 people, over half of them technically qualified.

The facilities of CARS which works closely with the Ministry of Railways include a complete Pueblo-style test track, and a post-graduate educational capability.

Were it in Australia, the CARS would seem to need an annual budget in the A$150-200 million range; this is about half that of our complete, all-disciplines, all-subjects CSIRO (2,500 scientists, 7,300 people, about $400 m).

The question that has to be asked is the visible evidence of payoffs from this massive research investment.

Critical study of the CARS itself by a team of experts would be necessary to assess this, but, on the basis of very limited exposure to the technology ***applied in the field,*** it could be said that the Chinese appear very advanced in areas such as building, civil engineering works, but less so in track maintenance, mechanical equipment and modern operating practice.

Lack of computing power, and restricted access to it appear to be major sources of weakness.

We were shown the central computing facility of CARS, and for a nation that has put satellites into orbit, its scale seemed very inadequate.

Indeed an investment in purchase of 10,000 desk top computers as "self-help" issue to the next generation of technical and operational people might well achieve more in operational results in a few years, than a highly-centralised approach to reinventing wheels has achieved in three decades.

Climax of Trip

After visits to Beijing, Nanjing, and Chengdu the party was taken over the famous Chengdu/Kunming Railway that links Sichuan and Yunnan provinces.

It was an unforgettable climax to the visit. The line is some 1,100 km long and was built in only six years, despite two years of holdups in the Cultural Revolution.

About 800 km of it lie in some of the most rugged mountain country in the world, yet the posted grades are only 1 in 60 in the northern and 1 in 80 on the southern sectors, with "standard" curves of 600 m and the worst, 400 m radius.

There are 1,500 tunnels up to 6.4 km long, and forth percent of the line is in tunnel or on bridge.

At one point, we were told, it is in both — on a subterranean bridge over a natural chasm in the tunnel!

The scenery is magnificent and the engineering work breathtaking. At several points it is possible to see four different levels of the same railway in the valley.

Words and pictures do it — and China — no justice.

You simply must try to visit there.

To see the country, absorb the culture, enjoy the railways, and marvel at the cheerful pride of China's railway people who are handling a transport task of breathtaking dimensions so well.

Mountain rail link opened up NSW

BLAXLAND, Lawson and Wentworth's crossing of the Blue Mountains in 1813 led to settlement of the rich farming and grazing land of western NSW, but providing a much needed rail link for the region's development was probably the hardest task ever undertaken by the State's railways.

In 1857 chief railways commissioner Colonel Martindale reported that a railway to the west must be built because the roads in winter were impassable by bullock drays.

Railway surveyors explored every possible route trying to find an easier way for the "iron horse" than that of the first explorers.

But in the end the Blue Mountains ridge was selected and the railway track was laid alongside much of the explorers' original route.

By 1861 the rail line had reached Rooty Hill, and in May, 1862 it was opened to South Creek — now St. Mary's.

By July of that year the line was opened to Cross Roads, now Kingswood — about a mile from Penrith.

Penrith was reached in January, 1863 and remained the terminus for the western line for just over four years.

Two interesting structures were built between Penrith and the Lapstone zig zag — a bridge and a viaduct.

The Victoria Bridge, designed by the railways' chief engineer, Mr. Whitton, spanned the Nepean River between Penrith and Emu Plains.

Originally it had three iron spans of 198 feet and was planned to carry a double rail track.

But the nearby road bridge was destroyed by a flood, and the rail bridge only carried a single line.

The other part of the bridge was reserved for road traffic.

A later flood carried away parts of the timber approaches on the western side of the river, and they were replaced by a fourth iron span, of 135 feet.

The viaduct crossing Knapsack Gully was also designed by Mr. Whitton, and is a remarkably graceful and solid piece of stonework.

It is 126 feet high at the centre and has seven arches.

The bridge and viaduct are still in use — now solely by road traffic as vital links of the Great Western Highway.

On July 11, 1867 the line to Weatherboard, now Wentworth Falls, was opened.

There were intermediate stopping places at Watertank (now Glenbrook), Wascoes (Blaxland), Springwood, Buss's (Woodford), and Blue Mountain (Lawson).

The 15-mile section from Weatherboard to Mt. Victoria was completed on May 1, 1868.

The next 20 miles to Bowenfels was opened 18 months later.

By February, 1875 the line had reached Kelso just across the Macquarie River from Bathurst.

The river was spanned, bringing the railhead into the town in time for the official opening on August 4, 1876.

Instrumentation coach will aid BR studies

British Rail's Research Division has commissioned a new and sophisticated instrumentation test coach to assist with experimental work on railway passenger and freight vehicles, including the furtherance of higher overall speeds for trains.

The coach has the ability to test innovative ideas at speeds around 225km/h — topping the present maximum of 200km/h — measuring the many necessary parameters as well as collecting and processing the resultant data.

Previously, such data collected from track tests has had to be subsequently analysed by research engineers at the Railway Technical Centre, Derby, English midlands — the headquarters of the Research Division.

The new system allows analysis to take place on-line, thus enabling experimental variables to be changed during testing.

Analysis and production of report quality figures will also be possible during transit to and from the test-sites with the benefit of making both testing and reporting far more efficient.

The coach is compatible with all InterCity vehicles, thus allowing its insertion into High Speed Train sets for test running at high speeds, but it is equally capable of being attached to freight trains for testing freight vehicles.

It is self-contained in that it has its own diesel generator to provide power for the data processing system and auxiliary systems.

The vehicle can therefore operate for long periods in almost any test train formation.

Named Argus, after the Greek mythological creature with no less than one hundred all-seeing eyes, the coach appropriately will cover a wide spectrum of engineering tests ranging from vehicle dynamics through to strain in components under service conditions.

Argus has the capacity to handle up to 60 channels of data from a wide range of inputs, including acceleration, velocity, pressure and current. Before being stored, various filter techniques can be used to limit the frequency range to assist subsequent analysis.

Data collection and analysis is centred on two DEC Computer Company PDP 11/73 computers, one of which converts test data into digital form which is then recorded on magnetic tape.

The second PDP 11/73 computer is used, with a suite of Prosig Computer Company DATS software, to access data on the magnetic discs to provide on-line analysis of the test data.

Data can also be collected on ultra violet recorders, 42 channels analogue magnetic tape, pen recorder and X-YY plotter. The test engineer can also be provided with output of selected parameters on analogue or digital meters.

The vehicle has been prepared by Research Division engineers at Derby, converted from a redundant passenger coach which had to be stripped totally and brought up to the latest standards for high speed vehicles.

Rail Video is 'very good value'

Recently released, "Just Australian Trains" is a two hour videotape containing seven films made by Film Australia and its antecedents.
The films were produced during a 30-year period — from 1947 to 1979. Each depicts, of course, one aspect of the Railways of Australia — but the variety of subjects and their treatment is very wide.
The quality is exceptionally good. Obviously transferred from original film stock, video clarity and sharpness is excellent, especially considering the age of some of the film material.
And at the price, the video offers very good value for money.
Film Australia has used people noted for their interest in rail — in one form or another — to introduce the video itself, and segments of it.
David Hill, until recently the Chief Executive of the State Rail Authority of New South Wales, heads the cast.
Earliest of the films is "Journey of a Nation" made in 1947, produced by one of Australia's greatest documentary film makers, John Heyer O.B.E., who speaks to the film at the outset.

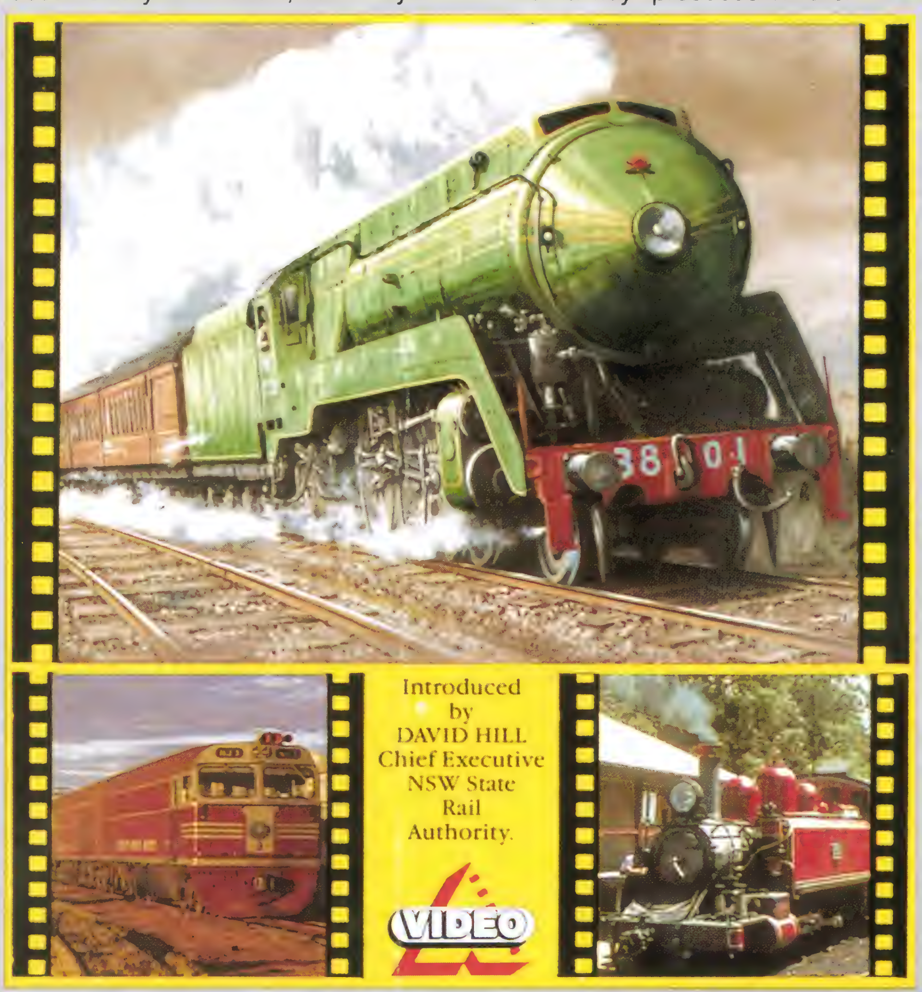
The film demonstrates the problems that beset Australia's railways at that time, when connection of capitals by a standard gauge railway was just a concept.

The film itself achieved its purpose of highlighting the problem and the work of eliminating one of the breaks-of-gauge began during the next decade.

The short film "On Time" centres around Flinders Street Station in Melbourne.

Concentrating on the signal boxes which formerly controlled what was then one of the world's busiest stations, the scenes evoke a great deal of nostalgia for those who remember the unheated, non-airconditioned, wooden-bodied rollingstock which characterised Melbourne's suburban services at that time.

"All Manner of Trains" shows how the Australian railways operated in 1960 and makes an interesting contrast with "The Railway" produced in 1979.



The Railways of Australia Committee had a hand in commissioning the latter film — and both are fairly solid documentaries, typical of their period. Both contain many scenes of great historical value and they will appeal to students of history — both railway and general.
Nostalgia continues in "The Ghan to Alice" an excerpt from which is included in the video.
The splendor (immediately post-World War II style) of the carriages operated on the old narrow gauge railway which were the pride of the Trans Australian service, is well displayed.
The problems of operating the former narrow gauge service between Marree and Alice Springs are perhaps not quite so apparent.
Viewers will know that today's service is a 24-hour, no-change-of-train, right through from Adelaide.
"Shades of Puffing Billy" is a 1967 film about the operations of one of the world's best preserved lines, running between Belgrave and Emerald in Melbourne's Dandenong Ranges.
It focuses attention on the volunteers from all walks of life who give of their time to make the railway operation possible — and the filming techniques will evoke some interest.
The video climaxes with its most recent film "A Steam Train Passes," introduced by Jack Sparkes, a former Locomotive Inspector with the State Rail Authority of New South Wales and who was heavily involved with the just-completed restoration to service of locomotive 3801.
It is no surprise that this film has won many awards and that it has been screened repeatedly on Australia's television stations.
It is an extremely evocative treatment of the concept of steam trains, and the place that they occupied in Australia's transport scene during World War II.
The change in style of production and direction is immediately apparent and the film is a visual delight.
"Network" commends "Just Australian Trains" to all who have an interest in railways and in things past.
"Just Australian Trains" is available from the Marketing Division of Film Australia, P.O. Box 46, Lindfield, New South Wales 2070. Price, in either VHS or BETA format, is $30.00 plus $5.00 for postage and handling fee.

The first of the new Brush 30-class triple-bogie electrical locomotives being unloaded from the container ship, Mairangi Bay, at Auckland. A few days later a second locomotive arrived. the two locomotives were then towed south to Palmerston North which is the main centre for the NMIT electrification. The 30-class is only slightly smaller than a N.S.W. 81-class diesel-electric, but at 3000kW the 30-class is slightly more powerful. Further details about the 30-class electrics can be read in NETWORK *Vol 23 No. 1.*
Photo: A. K. Sim.

Speed control system beats Arctic cold

A wagon speed control system which has worked successfully in Arctic conditions for the past year at a marshalling yard near Helsinki, Finland, is attracting considerable interest from state railway bodies.

The world's first operational installation of the newly-developed retractable retarder system for railway marshalling yards, developed by Britain's Dowty Hydraulic Units (DHU), is at Finland's Pasila marshalling yard.

It was required to face the severe climatic conditions of the Finnish winter and has performed faultlessly, even at temperatures dropping as low as −25ºC.

Designed, developed and made by DHU at its Cheltenham factory, it is based on the company's well-established range of hydraulic retarders and pneumatic booster-retarder units supplied to freight marshalling yards worldwide.

The new system is designed to meet demands for increased operational flexibility, particularly in smaller yards where the restricted number of tracks give rise to complex re-sorting and classification manoeuvres.

The ability to retract retarder capsules below the flanges of wagon wheels when not required greatly speeds up operations, increasing throughput of wagons as well as reducing wear on the retarders themselves.

The first system was developed in conjunction with Finnish State Railways.

Each unit has an integral pneumatic cylinder, connected to a central compressed air supply and control system, which retracts the retarder into its housing when air pressure is applied.

The entire network is controlled from a single point, enabling units to be retracted individually or in groups to meet the requirements of any given series of wagon movements.

Westrail improves its financial results

Westrail has reported an improved financial result for the second successive year.

The 1985/86 commercial result was a loss of $25.2 million. This was down $19 million (43 per cent) on the result for 1983/84 and a further $3 million improvement on 1984/85.

The financial result is included in Westrail's annual report tabled in Parliament by the Minister for Transport, Mr Gavan Troy.

The improvement in the commercial result was achieved despite a $2 million fall in revenue, Mr Troy said.

"Costs were reduced by $4.7 million through the continuing gains in productivity of staff, track, locomotives and rollingstock.

"For instance, the change to two-man crewing of trains, which was completed in July 1985, is producing cost savings approaching $6 million a year.

"Computers are now used for management, programming and revenue-accounting of freight train services.

"In all, productivity improvements brought cost reductions of $8 million in 1985/86 compared with the previous year.

"Against this, however, there were major losses of traffic. Income from hauling agricultural products was down $4 million and from energy commodities, mainly coal, $10 million. Ores and minerals revenue was steady," Mr Troy said.

Westrail made important investments in track and equipment during 1985/86.

The $10 million quarrying joint venture Western Quarries began marketing rock products.

Modernisation of wool transport was completed with the opening of the last eight mechanised wool centres in country towns. The $23.5 million track renewal of the Perth-Bunbury main line passed the half-way mark.

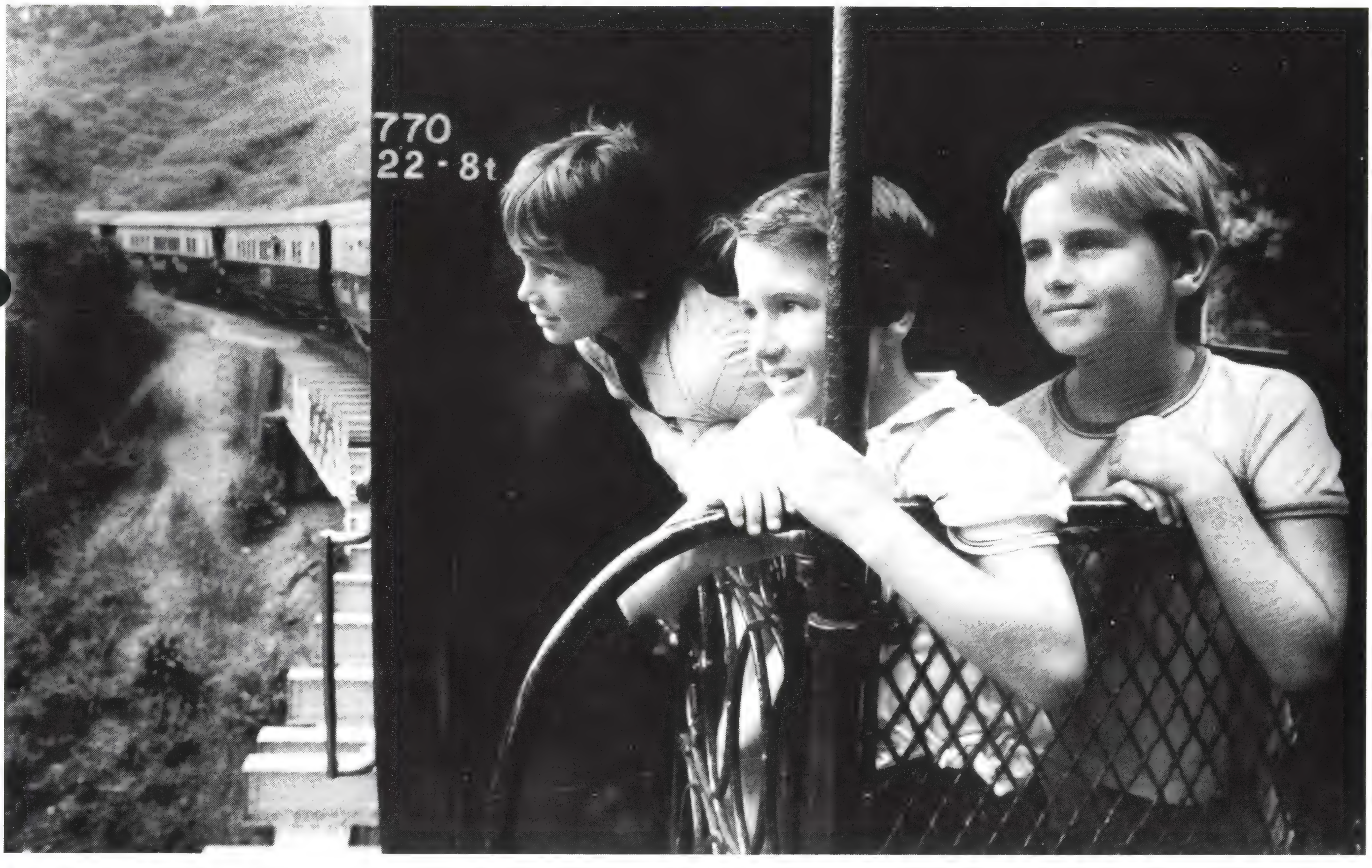
A $6.7 million high-speed train which will use this line has been ordered and will be delivered this year (1987).

Eight new Mercedes Benz road coaches were brought into service at a cost approaching $2 million.

The mechanical workshops continued their programme of building 98 new wagons for carting grain and rebuilding 160 others for fertiliser.

A $1.4 million programme to modernise signalling at Perth's City Station was begun in preparation for the $44 million Forrest Place-City Station redevelopment.

A youthful love affair begins . . .



Words are hardly needed to describe the enchantment on these young faces. A moment captured which marks that magic affinity between trains and the young, creating a seemingly never ending regeneration of recruits to the ranks of railway fans. These youngsters, obviously in a state of enjoyment of sublime proportions, are taking in the sights on Queensland Railway's Kuranda Tourist Train. Photo: Courtesy of the Queensland Sunday Mail.

The Overland is one of Australia's finest trains epitomising the best to be found in rail travel, from its exemplary staff services, comfort and magnificent scenery.

Our centre spread shows the Overland dressed in V-Line livery passing the Bacchus Marsh region on its way to Melbourne.


V/LINE

In conjunction with the Third International Heavy Haul Conference in Vancouver, the Institution of Engineers-Australia sponsored its annual Study Tour on Railway Engineering to North America.

A total of seventeen visitors from Townsville to Perth participated.

The STORE 86 program was developed to add significant technical venues before and after Heavy Haul to allow a more balanced and complete look at the North American rail scene as applicable to the Australian environment.

Cities visited included San Francisco, Seattle, Denver, and Chicago, with a few members of the party continuing to the eastern coast in Philadelphia the following week.

Assembling and leading the tour was Jim Michel of Amtrak ably assisted by Mark Rieper of SRA of NSW.

San Francisco

Hosts included the Municipal Railway (Cable Cars, Buses and Trams), BARTD (Regional Heavy Rail Transit), and California Department of Transportation (Diesel Suburban Services).

The program allowed a close look at the application of technology to monitor and operate several systems as diverse in scope as age.

The cable car system has its origins over 125 years ago, but was totally reconstructed in 1984 with new

From our U.S. Correspondent

hoisting machinery, track, cable guides, and safety controls. Don Haagstad and Richard Ware of MUNI gave the group a tour of the totally reconstructed Hoisting House and its complex safety mechanisms.

The Bay Area Rapid Transit system provided a briefing in their Oakland Headquarters with Joe Van Overveen, current chairman of the ASME Rail Transport Division, and Sharon Saslafski leading a multi-discipline discussion about train control, rollingstock, and permanent way.

The BARTD system connects San Francisco with the East Bay suburbs handling over 200,000 weekly trips on 71.5 route miles. The system utilizes magnetic fare cards to track revenue and ridership and was the first of the modern generation of heavy rail transit systems authorized in the 1960s.

The CalTrans commuter rail operation was explained by Cecil Smith and his associates representing a total re-equipping of the Southern Pacific operation between San Francisco and San Jose (the Silicon Valley computer area) 46 miles south of the city.

CalTrans assumed responsibility for the operation of this service in 1980 in order to provide an alternative to motorway construction, which was becoming unfeasible due to the lack of land corridors in this densely populated area.

EXPO 86 featured a special theme period, "Modern Rail 86"

There has been an 18% increase in weekday trips operated since that time and an aggressive marketing plan has stemmed the decline of riders.

The development of the Silicon Valley industries near San Jose has now resulted in a demand for reverse commuter service from the San Francisco end of the line.

The service just completed receipt of new General Motors F-40 (3000 Hp, Bo-Bo) locos and they are currently receiving the last of an order for 73 new double deck gallery cars.

The new car bodies are Japanese manufactured, then shipped to Pier 50 in San Francisco where final electrical and mechanical gear, brake equipment, and bogies are installed to provide the necessary domestic work content to meet the Federal mandates.

STORE members where given an opportunity to visit the Townsend Street Depot to view the new equipment and then were taken to Pier 50 to watch the outfitting of six recently delivered car bodies.

Before rushing off to Seattle, Dan Rosen of MUNI provided a comprehensive tour of the Market Street shared subway tunnel (BARTD and MUNI with four stacked tubes similar to Melbourne) facilities at Powell Street Station.

This station has a command centre with video and electronic surveillance of all major systems and equipment.

Australian pavilion at the EXPO 86.

STORE Group look

Many countries at EXPO 86 had rail and transport oriented exhibits. The West German pavilion had a mock-up of the TransRapid Mag-Lev vehicle and guideway.

Seattle

The STORE party arrived in Seattle late in the evening.

In the morning, Bill McCarthy, BN Pacific Division Engineering Superintendent, assisted by Deane Matthews and Frank Baker of Duffy, Lawver, and Kumpf, the designers of the facility, conducted a tour of the new BN Containerport on the Seattle waterfront.

This facility was designed and constructed in approximately nine months on a fast-track program in order to meet contract delivery dates of transcontinental container operations.

The facility is unique in that it is railroad owned, but operated by a harbor stevedore firm under contract.

There are only two railway management officers at the site, and the railway is responsible only for insuring the double high (6 metres above railhead) wagons are placed, inspected for operational readiness, and shunted when loaded.

The containerport was dispatching full trains to eastern cities 3-6 times daily, some trains being over 100 wagons long. The construction of the port had an Australian connection in that roller compacted concrete paving had been specified and an idle Australian concrete batch plant was imported to mix the paving materials.

Vancouver

The joke of the week in Vancouver was that Australian had become Canada's second language, with Australians comprising the largest contingent of non-North Americans at the conference.

The Heavy Haul Conference attracted 460 registrants who attended six days of technical programs and field trips.

The STORE party arrived in Vancouver to witness the last three days of EXPO, featuring a communications and transportation theme.

The EXPO offered an opportunity to wait in long queues and be part of a record crowd of over a third of a million people that surged into the grounds on 12 October.

The exhibit halls were filled with rail related exhibits, including many European and Asian manufactured goods. The French, German, Swiss, and Japanese pavilions featured their rail products most heavily.

The Canadian railways, CN, CP and VIA, each had their own pavilions with many equipment displays.

The last two weeks of EXPO were featured as a "Modern Rail" theme period, with the US and Canadian railways setting up static displays of rolling stock specifically for visiting railwaymen from around the world. Included was one of the new CN microprocessor diesel electrics with the "Draper Taper," and one of the 50KV British Columbia Railway GF6-C electric locos (3800KW-CoCo) in impressive red, white, and blue livery. These units are used in Northeastern British Columbia to haul export coal on the new Tumbler Ridge rail line.

The Heavy Haul Conference assembled a diverse group of railway specialists, many of which were not heavy haulers, but recognize the value of the engineering data collected in the heavy haul environment.

The dedicated train services of the coal and iron haul lines provide the opportunity to conduct controlled testing on an accelerated schedule, a fact not lost among even the passenger oriented European systems.

Major advances in train control using inexpensive computer hardware, radio data links direct to locomotive cabs, and earth-orbiting satellite position fixing offer opportunities to provide better management of operations without expensive wayside communication networks.

The Union Pacific is already employing the first stages of such a system, and the joint Canadian/American Advanced Train Control System (ATCS) should be into revenue testing by 1988.

This ATCS Project is perhaps one of the most "international" railway efforts ever mobilized with railways of seven nations and hardware suppliers from ten countries actively participating.

Also at the conference were many papers on the state of the locomotive industry as it relates to heavy haul with papers from West Germany, Canada, and the USA on the benefits of AC traction in diesel-electric units, the desire for units of 6000HP in a DoDo configuration with radial bogies to achieve adhesion levels in excess of 30%, and the use of 50KV electrification schemes that begin to improve the economics of electric traction.

There was also discussion of the bi-modal diesel-electric/electric unit that would offer the necessary tractive effort on heavy gradients from the catenary, but generate its own power at lower horsepower levels on the flat, thus significantly reducing the first cost of wiring the permanent way.

(continued on page 37)

s at North America

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In San Francisco, Don Haagstad, MUNI Director of Cable Car Maintenance, points out some of the features of the cable car running gear to Doug Beath of Emu Bay Railway.

Cable Car No. 19, being returned to revenue service after total restoration, loads up the STORE party for the first trip from the Car Barn to Powell and Market Streets.

The woodwork and trim on the interior of Car 19 were only to be outdone by the Gripman's colourful suspenders.

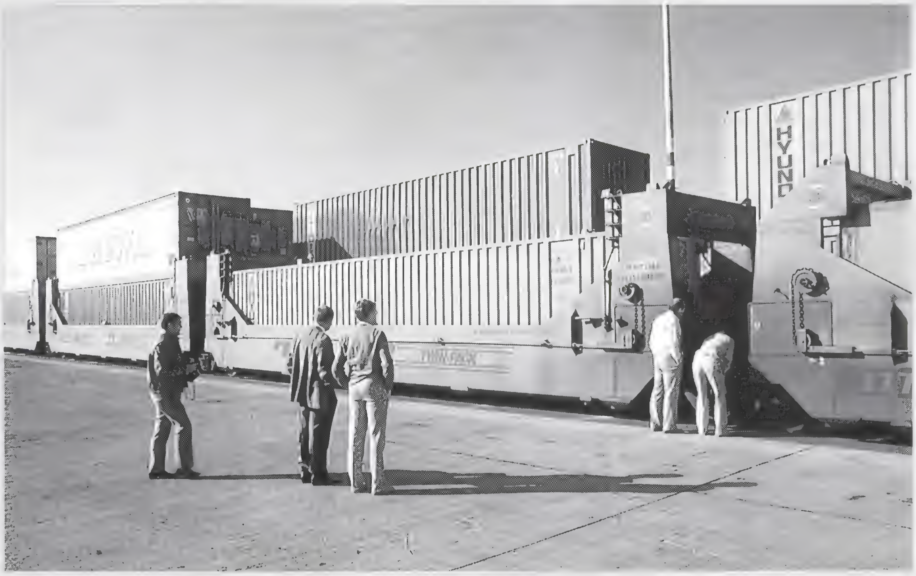
Above right:
STORE members visited the Amtrak Chicago Maintenance facility to view the various types of passenger stock and F-40 diesel-electric locomotives.

Mark Rieper of SRA/NSW watches the loading of a container on a single level container wagon at the Seattle BN facility. The terminal has three gantries and several other tractor mounted container lifters.

The Conference program offered many papers by Australian authors with Durham Davis of Mt. Newman Mining and Ian Nibloe of Queensland Railways serving as Session Chairmen.
The Heavy Haul Conference concluded with an overall assessment of the state of the heavy haul industry.
Field trips in Vancouver included a visit to the Robert Bank Coal Terminal, which unfortunately suffered from a schedule foul-up with the port management expecting the group some four hours prior to the actual arrival.
The tour offered a good look at the facility without much narration. On Saturday, the Canadian National Railway operated a special train through the famous Fraser River Canyon approximately 150km east of Vancouver with numerous stops to inspect permanent way improvements. The CN made their track inspection wagon available to view the track and magnificent scenery of the region.

Denver

The Association of American Railroads operates the Transportation Test Centre at Pueblo, Colorado, approximately 200km south of Denver.
This offered the STORE party with its first opportunity to keep to the right on the motorway using a self drive hire van.
The numerous test projects underway at Pueblo were viewed and discussed with the staff, including the FAST track (accelerated testing of perway components) and the Rail Dynamics Laboratory.
In the course of a five hour visit, it was possible to inspect over a hundred different types of testing apparatus in many different railway disciplines. However, John Lundgren's staff of engineers and scientists offered a concise overview of the centre's capabilities and resources. The programs underway at the TTC are now primarily funded from private railroad and manufacturer sources as government supported efforts decrease.
Several of the STORE party opted for the Amtrak trip from Denver to Glenwood Springs and return. This trip over the route of the Denver & Rio Grande Western Railroad climbs the Front Range of the Rocky Mountains up to the famous Moffat Tunnel at 2800 metres above sea level.
The trip provided an opportunity to inspect the double deck passenger stock (sleepers, diner, sightseeing lounge, and economy open seating types) as well as view the numerous passing goods trains and marvel at the massive civil engineering works of this rail line.
Before departing Denver, the Denver and Rio Grande Western hosted the STORE party to their train control centre in Denver where they dispatch and operate all the rail line between Denver and Salt Lake City over 2900 kilometres of route.
In addition to signal and crossing loop control, the dispatcher can directly talk to any train via radio anywhere on the system with no middlemen.
Since most of the DRGW was already controlled by Centralized Traffic Control, the combining of several dispatcher offices into the Traffic Management Centre was achieved largely through computerization and software in Denver, with minimal communication interfaces at the field locations.
The system also records train performance data directly to the central computer data base, eliminating much of the paperwork found in many control schemes. This centre features the latest in VDU technology as well as automated train staffing.
The computerized system determines from its data base the next eligible personnel to be called for duty, automatically telephones these people, logs their response, and establishes the pay record upon which payroll is finally based.
The system has improved productivity of the clerical and financial staffs by eliminating errors and providing more accurate application of labour agreements with the unionized personnel that drive the trains.



STORE members probe the inner details of the articulated, "double stack" container wagons that move in dedicated unit train service to the eastern part of the USA. Each wagon is composed of 5 well units 18 metres long with a maximum loaded height of 6 metres above railhead.

Chicago

The Chicago program of two days duration had several concurrent events to allow separate fields of study.
The Santa Fe Railway offered a tour of their Corwith Yard Intermodal Facility, one of the largest truck/rail and container/rail operations in North America handling over 1600 boxes per day.
One part of the STORE team visited the Electro-Motive Division manufacturing plant in LaGrange, Illinois to view the fabrication of diesel electric locos.
Alastair Rae of the Overseas Sales Department made arrangements for a three hour tour that showed a loco starting as a collection of metal shapes and sheets, that ultimately rolled out the door as a functioning locomotive. The EMD personnel throughout the plant displayed extreme pride in their jobs and their self administered quality control system.
For those not interested in two-cycle engines, the Association of American Railroad Technical Centre presented a tour of their laboratories.
The Track Materials Laboratory at 47th Street offered a look at the equipment that can create any combination of track, ballast, and subgrade and determine performance of the structure to a depth of four metres below railhead. This test installation can consolidate the roadbed at the rate of 50,000 short tons per hour

The final assembly area of the Boeing Airplane Company plant in Everett, Washington was visited by STORE members. A future QANTAS jet can be seen near the door.

using hydraulically powered actuators.
The Illinois Central Gulf Railroad hosted a tour of their Woodcrest Shop, one of the few rolling stock facilities in North America doing locomotive rebuilding, passenger car maintenance, and Perway Equipment maintenance under one roof.
The trip from downtown Chicago allowed a first hand look at the last 1500 volt DC traction installation using double deck gallery type EMUs. The Melbourne and Sydney electric traction experts on STORE had a most rewarding visit sharing notes on 1500 volt equipment and practices.
The shop contains a fully enclosed transfer table to allow movement of equipment into any one of 42 tracks in the 500,000sq. ft. building.
The Amtrak Chicago Shops and Passenger Service Yards were visited by some of the party. The visit allowed an inspection of the various types of passenger stock used in the United States including the double deck Superliners and the low level Amfleet equipment.
The highlight of the Chicago visit was the trip to the RALES loco training simulator at the Illinois Institute of Technology Research Centre.
This simulator was developed with a Federal DOT research grant and is patterned after fully active airplane simulators.
The cab is a full scale EMD SD-40 with hydraulically operated, six degree of freedom, actuators to duplicate any event that can occur in the real world.
Because the simulator uses dual 35mm film projectors which allow alternate events and a projected image of the actual track route, it is possible to prequalify engine drivers in the simulator before they are sent out on the line.
The RALES simulator is currently doing contract training for one railroad and is seeking additional contracts to make this research project a profitable enterprise.
The twin computers can simulate trains to 120 wagons with up to 10 locomotives, including slave units with "LOCOTROL" over any line profile. To provide a realistic environment, the sounds of a diesel cab are also included such as engine noise, level crossing warnings, air brake actuation and release, and driver alert systems.
One of the STORE members who claimed an engine driver background, was permitted to climb into the cab and prove his abilities.
It is most fortunate that this was a simulation, otherwise the wreck crew would still be picking up the wagons from both sides of the line.
The STORE 86 program came to an end in Chicago with a small reception for the Chicago area hosts.
The pub immediately behind the 1920s Chicago Union Station, provided an informal setting to meet and say goodbye to all who made STORE 86 a success.
The group was most fortunate to have Mr. Frank Richter, Editor of Progressive Railroading magazine, join the dinner and offer his impressions and observations of the Heavy Haul Conference from an international perspective.

Store '87 to SA and NT

The annual Study Tour on Railway Engineering, organised by the National Committee on Railway Engineering of the Institution of Engineers', Australia, is to be held in South Australia and the Northern Territory from 20-30 June 1987.
The tour will commence in Adelaide and include inspections of facilities of Australian National and the State Transport Authority of South Australia including terminal activities, bogie exchange and intermodal operations, S.T.A. re-signalling project, mechanical maintenance workshops and Adelaide station remodelling.
Visits will be made to McKay Components, manufacturer of the Safelok rail fastening, and Comeng, to inspect fabrication and assembly of the new 3000 Class diesel electric railcars being constructed for the S.T.A.
A train trip on the tourist line to Victor Harbour with inspections of the track rehabilitation works, locomotive sheds at Goolwa and restored 620 Class locomotive, Duke of Gloucester, will also be undertaken.
The facilities of the Glenelg tramway and O'Bahn guided busway will be examined. The tour will move onto the "Iron Triangle" of South Australia and inspect concrete sleeper production and coal wagon tippler unloading system at Port Augusta and rail rolling and steel sleeper production at Whyalla.
The famous Ghan train will then be boarded for the overnight trip to Alice Springs where intermodal and other yard facilities will be viewed.
A two-day tour to Ayers Rock will precede return to Adelaide on the Ghan on 30 June 1987.
The cost of the tour will be $590 plus Ghan fares in accordance with choice of accommodation requirements.
Full details are now available from the Conference Manager, The Institution of Engineers, Australia, 11 National Circuit, Barton A.C.T. 2600.

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Maglev moves over a million

By Richard Brookes

Maglev, the revolutionary rapid transit system that carries its passengers literally riding on a cushion of air, is now celebrating two years of trouble-free and popular operation.
During those two years, its operators at the international airport for Birmingham, in the English midlands, estimate the system has carried more than a million passengers on its 90 second journey between the airport terminals and the nearby Birmingham international railway station, which is part of the National Exhibition Centre — Britain's largest and most important exhibition complex.
The success of Maglev (its name is short for MAGnetic LEVitation) has understandably brought much satisfaction to the consortium of leading British companies, trading under the title of People Movers, which built and installed it in 1984 as part of a general improvement and expansion of Birmingham airport.

No Wheels

For, in meeting the challenge that faced it in developing Maglev, the consortium felt it was following in the pioneering steps of such great British railway engineers as George Stephenson, who invented the steam train, and Isambard Kingdom Brunel, who brought about the concept of rail travel as we know it today.
The essential factor to remember about Maglev is that it travels without the aid of wheels.
Described by some as a "horizontal elevator," it has two parallel tracks with a two-car train on each. Both trains are controlled automatically by computers.
The passenger cars rest on a steel suspension rail, and electromagnets attached to each car loop under this track. When the current is applied, the magnets are attracted to the track, lifting the car about 20mm.
An on-board computer then regulates the electricity to maintain this tiny, frictionless gap.

Linear Motor

Forward motion comes from a linear motor that is virtually a conventional electric motor flattened out.
Instead of spinning, it induces linear travel, "pushing" against an aluminium "reaction rail" on top of the support rail.
Once the train is in motion — at anything up to 48km/h — small rollers prevent it from tilting too far, and its speed is monitored constantly by radar and corrected accordingly.
If the train becomes unsafe in any way, it is automatically slowed down or stopped.
Although there is no driver in the 38-passenger trains, travellers can speak directly to controllers via a radio link.
Maglev has many features that make it an ideal choice for rapid transit.
Because there are no wheels, there is no friction or wear on tracks and other exposed operating parts. Maintenance is minimal and operation can be totally automatic.
This means that a whole transit system can be operated with few staff, thus enabling costs to be kept to a fraction of those of a conventional railway.
In fact at Birmingham the whole system is operated without any toll charge to the passengers — perhaps the only free public service ride in Britain.

Huge Sales Potential

Some £4 million was spent in developing Maglev, about half of that sum coming from the local regional authority.
Now that the faith behind the project has been seen to be justified, the potential world-wide sales are enormous, with figures of anything up to £1,000 million being quoted.
The irony of the Maglev story, however, is that the technology had to wait several years before a suitable application came along to warrant development.
The first working prototype was demonstrated by British Rail as far back as 1973. The problem then was that no-one could think of a suitable use for the principle.
For example, most airports which need to move passengers continually to and from aircraft opt for conventional methods of transit such as escalators and moving pavements.
When new developments were planned for Birmingham airport, however, a system was needed to transfer the 15% of passengers who were either visiting the National Exhibition Centre or who wished to catch a train at the railway station.
It was realised at once that Maglev would be an ideal system to install.
John Walker, technical director of Birmingham airport, believes that the first Maglev to be used outside Britain will be installed within the next two years.

Numerous Inquiries

"It is hard to state categorically when the next Maglev will be installed," he says, "but it is really only a question of time.
We are receiving inquiries from throughout the world at an enormous rate, and many of these are being developed into detailed proposals.
Some are at final planning stages for implementation over the next few years."
The Birmingham experience has highlighted the important role that Maglev can play in moving people and goods from one place to another.
Whereas in the early days in the 1970s, application were thought to be limited, Birmingham's Maglev has now proved that the scope for adopting the system is wide.
As Mr. Walker explains: "Maglev is applicable to any situation where the movement of people or goods is required on a constant and possibly automatic basis — either from one place to another, as in the case of Birmingham, or on a circular route."

For Shopping Centres

To give one example, Maglev is being very seriously considered for a number of shopping centres throughout the world as a means of transporting members of the public from car parks into the shopping precincts.
The fact that Maglev is totally pollution free enables it to pass through buildings instead of going round them.
In its two year life, Maglev has proved itself as a revolutionary new technology and transportation concept.
It is only a matter of time before the Maglev concept becomes as widely known throughout the world as the conventional railway.

Sentinels PART 3

In previous articles we have seen how today's railway signal engineers are able to guarantee that the advice given to the Driver from a lineside or in-cab signal is effective, reliable and safe — and as close to 100 per cent on all three counts as human ingenuity and diligence can make it.

This goal has also been achieved at steadily decreasing operator and maintenance cost, but not always at reduced system capital cost.

We also saw that behind every clear signal facing the Driver there lies solid assurance that the way ahead is set up, proven clear, and positively locked up against any other conflicting train movement that could make it unsafe, until the train has passed.

The modern signal system is ***always*** designed and tested to be exceptionally reliable, and absolutely ***fail-safe.***

Driver Error

All this ingenuity counts for nothing when the signal is at danger, the Driver ignores it, and the train runs past into an obstruction beyond.

Around the world, most of the collisions that do occur on modern railways today are due to Driver error.

It must first be said that few Drivers have ever over-run a danger signal (which we will shorthand by calling it a red light).

The whole system is designed to minimise the risks of their doing so. Signals are not planted anywhere, but positioned very carefully to minimise the risk of being missed or mis-read, and in-cab devices (called "vigilance controls") keep the Driver alert and stop the train if he becomes inalert, drowses off, or even drops dead (which has happened).

The system is also designed to ensure that before he encounters a red light, the Driver will encounter at least one and in suburban areas usually a whole series of cautionary yellow lights.

Signal gantry south of Laverton, Victoria.

...of safety

There will often be an extra red inserted between the last yellow and very last red light before serious trouble.
And there is always an "overlap" allowing some overshoot, e.g. due to misjudged braking, between the final red and the obstruction.
And yet, all of this ***additional*** ingenuity still counts for nothing if the Driver ignores the final red light and runs into an obstruction beyond.
Your author who as a young man was in the cab of a steam-hauled express, recklessly driven through red signals, and later himself drove a train through a red light (both at 100km/h, and ***not*** in Australia) can attest that overrunning a signal is a very easy thing to do and a quite terrifying experience.
The fact that so very few red lights ***are*** overrun is a tribute to the responsibility and care of our Drivers, and few of those people who criticise them for the ultimate human failure of over-running a signal have the personal experience conferring the right to cast the stone.
But every human is fallible.
On both sides of the Atlantic since 1850 and here in Australia from the Edwardian era up to the present time, inventive minds have attempted to devise systems that will positively stop trains from running through red lights.
And having stopped the trains, discouraged them starting up again to hit the same obstruction.
The stopping part of the action is relatively easily achieved; all you have to do is to actuate a valve that will vent the automatic brake pipe to atmosphere.
On an electric or diesel train, an air-operated power/throttle knockout switch connected to the same automatic brake pipe will shut off the power.
So the train will come to a stop all right — and a very abrupt, juddering stop at that.

The Problem

The difficulty lies not in the stopping, but in deciding where and how to ***start*** stopping.
Where do you initiate it? How do you reconcile insistence on a compulsory stop with the common situation of yellow or red signals that turn green after the train has slowed down?
How much do you leave to the Driver's responsibility?
When deciding how to protect against the Driver's very rare failure, is it a proposition to move from 99.99 to 99.999% security, at 100 or 150 per cent extra cost of equipment that may never be used?
Is the unreliability that often follows complexity likely to result in more equipment failures and, with these, the more frequent use of relatively risky emergency working procedures?
Will the cure be worse than the disease?
These are the very real issues that you ***don't*** read about in the editorials after the rare accident, or hear from learned counsel for the prosecution when some poor wretch's case comes up after a tragedy.
The difference between the layman's and the signal engineer's approach to the problem of stopping trains that run past red lights is that the layman sees things as black and red — black after he sees an accident on TV, and red if his train is delayed by a signal failure that causes major traffic delays in the peak hour.
The signal engineer, who deals in relativities and (today) increasingly in statistical risks, knows that systems are built around humans and Rules as well as equipment.
And no system can ever be absolutely, positively, 100.00 per cent safe.
Even automated railways have had collisions, because humans put the equipment in and, when it fails, humans have to institute the emergency drills that get you home.
The signal engineer is also aware of the fact that there is no such thing as being half-safe when you are spending millions of dollars on a comprehensive protection system of this kind.
All the trains and ***all*** of the potentially red lights have to be covered.
The combined laws of statistics and Murphy are working against you to seek out the points of weakness in your system.
The whole railway is itself engineered, organised, staffed and operated as a safe system, and the technical safety package is a sub-system of the railway — a vital one.
Signalling as such is one vital sub-system of the safety package. The protection against overrunning red lights is another level down the tree of sub-systems.
But on some railways, the number of train movements, and the number of signals that may be red, are both high. The risk becomes unreasonable and the provision of positive protection against signal overrun becomes essential for statistical reasons alone.
There are two approaches to preventing a train from overrunning a red light.
One is to initiate the stopping process ***at*** the red light, and to provide space for it to brake to a halt between the red light and the obstruction (e.g. the train ahead, a conflicting junction).
The alternative approach is to initiate stopping ***before*** reaching the red light, so the latter is never passed at all — just as we are required to do when driving our motor car up to the traffic lights.
The first approach is relatively easy, given money and room to find the distance; it can be and it has been made virtually foolproof.
The second approach is also relatively easy, given money and it can be made only marginally less foolproof. At a much lower cost than the first option, too.
But achieving the second option in a single, universal system that is totally foolproof (i.e. that picks up the first option as well) is, to quote one signal engineer "quite difficult, and bloody expensive." And this is especially ***true when the railway already has a standard system in place;*** which those railways with the statistical need already have.

Approach 1 — Signal Trip Systems

Signal-trip systems date from the turn of the century, and are found on most old-established city undergrounds;* the suburban areas of Sydney and Melbourne have long used them.
Set on the track beside the signal there is a small box, about the size of a thick attache case, from the side of which a mechanical trip arm is raised when the signal is red.
The electric train carries, on a leading left-hand axlebox, a mechanical trigger which is connected to the trip valve (tripcock) that vents the automatic brake pipe.
When the light is red, the trip arm is raised (by a counterweight, so that it fails safe). If the train overrides the signal, the moving trigger strikes the raised trip arm, the air brakes go on, the power is knocked out, and the train stops.
Nothing could be simpler, safer, or more reliable. And few solutions have been better — for over eighty years.*

* The Paris Metro — one of the world's oldest undergrounds has never used signal trips but moved straight from total reliance on the driver for 60 years to advanced in-cab systems.

But let's extend our thinking a bit. Is our train moving at a prudent 20, or 30km/h, or is it being illegally driven by a madman at 130km/h?

The braking distance will vary according to speed; how much distance are we to allow between the red light and trouble?

Is our train an electric train? (The answer here is yes, because almost invariably only electric multiple-unit trains are fitted with tripcocks).

Suppose it's a fast-moving country express — the train will require longer braking distances, and if it is a heavily-loaded goods train, possibly a longer distance yet again.

This means setting the red light a long way back if we're to cover all contingencies.

The trip arms on the track are a source of considerable income to signal manufacturers.

For they are a heavy, precision-built piece of mechanical equipment — fearsomely expensive, the all-electric models especially so.

The simpler electro-pneumatic model (EP, i.e. solenoid valve and air cylinder) is substantially cheaper — so much so that in NSW it has been found a proposition to pipe compressed air throughout the City and Eastern Suburbs railways, the resignalled Sydney-Strathfield area, and even all the way from Liverpool to Campbelltown, primarily to work the signal trip arms with EP control.

Cheaper, but still very, very expensive when you are signalling a complete network — because as we shall see, we will also need shorter signal blocks.

On the train, there is considerable doubt as to whether mechanical triggers and tripcocks will reliably withstand the impact of clouting a raised trip arm at speeds much above 90km/h.

After all, there is little point in fitting a system to a really fast train if there is a remote risk of the trigger on the axlebox breaking off, and failing to vent the brake pipe just when it's needed.

Claims that the system is "unsuitable" for loco-hauled trains purely because they are loco hauled are somewhat more dubious; the air brake would not know whether it was vented by a trip valve or a burst hose, and some steam engines in Melbourne and in London used to have tripcocks.

But the fact remains that no railway is known to have protected a main line with trip arms since around 1923 and that system used smashable wooden triggers — the "Reliostop," tried on section of the old Great Central Railway in England.

The balance of judgement has to be that mechanical tripping is a well-established and very safe system, but one essentially suitable for suburban trains alone.

Trip installations have therefore been extended, as an established system, on all postwar extensions of ***suburban*** electric working in Sydney and Melbourne, but not into outlying areas of the faster ***interurban*** main line electric working.

And all trip installations have been predicated on the principle that there will always be sufficient distance, beyond the raised trip arm, to halt a train within the braking distance for the maximum speed at which it could reasonably be expected to be travelling, before it runs into trouble.

In busy parts of the railway (close-headway areas) this means more signals i.e. shorter signal blocks, to provide not one but ***two*** red lights and raised trip arms between us and the train ahead.

In short, lots more track circuit and signalling equipment and lots of expensive trip arms — all a source of delight to the signal supplier, but of dismay to those who have to find the money.

This is the price of safety when you are already committed to an established standard on a large network.

There is a noteworthy and old established variation of this in Sydney on the City and Eastern Suburbs Railways and at the approach to certain key junctions, where trains frequently have to close up ***at very low speed.***

The technique used is to trip the train not ***at*** the red light, but in ***advance*** of it, using a series of additional advance trip arms worked by special track circuits that time the approaching train by track circuit to prove its low speed.

You can watch their action from the platform as a train pulls out.

On the Sydney City Railway, the Drivers will first read and react to the colour-light caution signals and finally close up to the train ahead by watching the trip arms drop one by one ahead of them, as they crawl closer to it.

There is always at least one final trip arm, stoutly raised to prevent even a walking-pace rear-end collision.

And the installation is very cleverly designed and matched to the train's accelerative powers, so that even a maniac cannot suddenly accelerate, try to "beat the system," and hit the train ahead with the brakes on after the ultimate trip.

The system was introduced as far back as 1926, against "expert" advice from an overseas railway that many years later, encountered the second-worst underground train crash in history at a dead-end tunnel totally unprotected by Sydney-type speed trips.

The City Railway system has worked impeccably for 61 years.

But it deals with only one kind of train — the 160km/h XPT, the 115km/h Brisbane Express, and heavier coal trains do ***not*** run through Wynyard.

And its expense rules it out as an option for the general, system-wide installation that would be needed to achieve Approach 2 with trip arms.

A final note on trip arms: despite their splendid record for eight decades, rear-end collisions have occurred — a very few — on suburban railways equipped with this protection.

Approach 2 — Automatic Warning Systems

On main-line railways where traffic may be running at speeds from 90 to 160km/h, the signal critical to safety is ***not*** the stop signal at all — i.e. the red light.

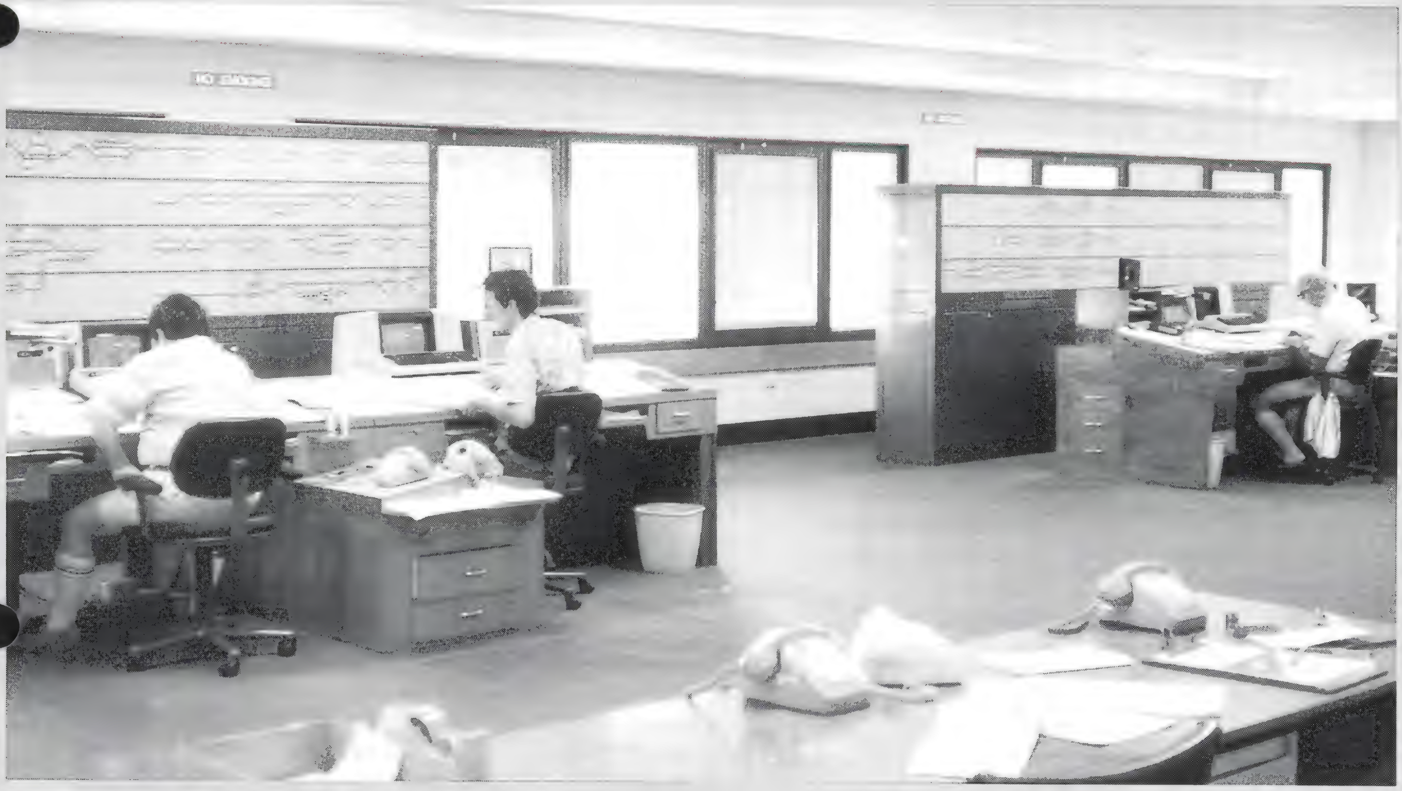
It is the caution signal (yellow light) that precedes it and in very high speed or high density/high speed territory, the advanced-caution (e.g. double yellow) that in turn precedes the single yellow.

This is because it can take a heavy main line train a long distance to stop, especially on a downgrade, and even in the case of an emergency stop.

The standard British Railways "composite" braking curve, which combines normal "service" stops of main-line passenger and freight trains, assumes a service braking distance on level of over 1km from 100km/h, and on a 1 in 60 falling grade from 160km/h, no less than 3km.

And sighting and reaction time allowances add to these distances.

It is pointless to attempt to initiate braking that the Driver cannot override, far in advance of a red light that he cannot see (e.g. because curves, bridges or tunnels are in the way).



Control Room, Rockhampton, showing two of the CTC panels and control desks with VDUs.

And the red would, more often than not, turn yellow or green long before the train screeched to an uncomfortable and quite unnecessary halt just before the previously-red signal.

In contrast, it is obviously essential to place a cautionary yellow signal at the advance warning point, so that the Driver will initiate his braking in good time.

It is highly desirable to remind him to react.

And in some circumstances it is essential to ensure that if he does ***not*** react at all, emergency braking will be applied, automatically and irrevocably, in time to stop before the red is overrun.

This philosophy is the basis of all automatic warning systems (AWS).

AWS recognises the crucial importance of the distant signal (yellow light), and it backs up with a penalty brake application, the Driver's failing to react to that signal's warning.

On the classic AWS introduced by the Old Great Western Railway in England (Fairford branch 1906, Reading-Paddington 1908, system-wide by 1938) the hardware consisted of a long, rising steel ramp between the rails that lifted a shoe under the passing locomotive.*

If the distant signal was "on" (yellow light) the ramp was de-energised; the shoe-lifting action sounded a siren, and after a short time, applied the automatic brake (in those days, the vacuum brake). The driver could cancel this and take over the braking for a smoother stop — if he ignored it, the train stopped anyway.

If ***all*** the signals for running through a station were "off" the distant signal would also be at clear (green).

The ramp was then energised by a trackside battery, the electrical contact with the raised shoe causing a "line clear" bell to ring in the cab and a solenoid valve to hold the automatic brake off. While heavy on mechanical maintenance, the GWR system was superbly simple and totally fail-safe, and in over fifty years of its use the GWR had only ***one*** accident caused by Drivers (of GWR locomotives) overrunning stop signals.

That case occurred during the last war, when a Driver who had been bombed out of his home the previous evening, tragically misread his signals and subconsciously cancelled the AWS.

During the same fifty-year period the other British company railways — LMS, LNER and Southern — each had a depressing chain of rear-end collisions, culminating in British Rail's inheriting from them the root causes of two terrible commuter train disasters at Harrow (ex LMS) and St. Johns, (ex SR).

Both took place in fog when Drivers overran signals and ran into the train ahead; both killed over 100 people and injured hundreds more.

The improvement on the GWR's mechanical-contact system was the Hudd magnetic AWS (1938) and later, the improved BR version, which was on field trial when Harrow occurred in 1952.

It has since been installed through the BR network.

On this, there is a permanent (which means an always energised and active) magnet at ***every*** signal, followed by an opposing electromagnet, which is energised only if the signal is clear.

Every clear signal rings a bell, and every caution (or a danger) signal sounds a siren. Unless the caution is consciously cancelled, a penalty brake application results, stopping the train.

Additionally, the Driver has a spoked-wheel display on his control desk to remind him that although he has cancelled a warning he is now in caution (i.e. yellow-light) territory and the next signal coming up will be another caution or a stop.

Only when he has passed a green will this extra in-cab warning indication disappear.

A final word on AWS: some lay commentators have observed that it is

*The French "Crocodile," which vaguely resembles that reptile, is similar but uses a metal brush for electrical contact.

basically a main line system (which is true) and that it is therefore "unsuitable" for suburban conditions. The latter is patent rubbish, for ***all*** the lines into the great termini in London and the provincial UK cities are protected with this well-proven AWS. There are around 48 suburban tracks leading into London alone; only eight lead into Brisbane.

QR chose the British AWS some 15 years ago for installation in the Brisbane suburban electrification, first opened in 1979.

The Search for a "Perfect" System

The criticism of trip systems is that they are 100%-secure but unsuitable for universal use; the criticism of AWS is that although universal, it is not 100%-secure because its warning can be cancelled by an irresponsible Driver.

The "perfect" system required the combination of warning, which ***must*** be reacted upon by a proven reduction in speed, and the application of penalty braking to ensure absolutely that the red light is never passed.

Both can be done — at a price.

It will be appreciated that the trip and AWS systems hitherto described are "intermittent" systems; both receive inputs from the track ***only*** when the train passes each fixed signal.

This is because both systems were designed (and have been used) for retrofit to an existing mechanically-signalled railway, where the lines may not be continuously track-circuited. The former mechanical signalling installations in Melbourne had trips; the BR AWS was likewise designed for and (it is believed) applied to some mechanically-signalled areas in the UK.

If the lines are continuously track-circuited (which as we have seen is a major source of cost, and not always justified) it is possible to add extra equipment and use the rails to feed — right into the driver's cab — a series of electronic speed-command "signals" that the Driver must follow.

The commands can be displayed either as lights, or as a maximum/reduced permitted speed.

It is also possible to police the Driver's adherence to these commands by penalty brake applications and to make the equipment fail safe, which means an emergency brake application if any of the equipment fails.

It is further possible to use these commands to apply power and brakes, driving the train automatically without human intervention.

This is called Automatic Train Operation or ATO.

Such systems exist; the Japanese Shinkansen, the French TGV, and the Italian Direttissima (all main lines) and most metros newly-built since 1960 have them.

But they are all formidably expensive, requiring very high volumes of traffic and statistical risk to justify this cost.

The technology of continuous warning systems is constantly improving, however and, with electronics, costs are falling.

So the Australian signal community is monitoring the situation for possible use here — mainly for suburban, and possibly for interurban and dedicated heavy-haul areas.

For all practical purposes the cost is that of installing a completely new system, network-wide and in the suburbs the extra benefit is only that of adding that last minute fraction of 0.1% more protection above that given by the trips or AWS that are installed now.

Of more interest as a retrofit proposition is an ***intermittent*** system that would be almost as good, but that would need to discriminate between two things:

- the caution signal, enforcing a reaction by the Driver, a speed reduction, and thereafter an enforced maximum speed. A little thought will show that merely sensing an application of the air brakes would not work; such a solution would require a series of unnecessary slow-downs/speed-ups when following another train through a succession of yellows, when a steady slow speed is preferable.
- the stop signal, which ***must*** be approached at an acceptably slow speed and which, if passed at all, must result in a non-cancellable penalty brake application that will

Ground frame operated siding points in CTC territory.

stop the train within a safe, short, prescribed overlap distance.

The Sydney City Railway system in effect does this — but only at relatively slow speeds, with one kind of train, and at a very high cost in equipment based on an obsolete technology.

The Brisbane AWS could in theory be modified to do this, but would require extra track magnets, a more sophisticated sensor and electronics and, at the minimum (it would seem), a coupling of the new safety system to an exceptionally reliable electronic speedometer.

Australian signal engineers have thought hard about these issues and one enterprising firm has developed a sub-system that the newspapers would call a "breakthrough" in this area.

The critical gadget is on test; the complete system is a while ahead. When it is ready, it should be a winner, since it is suitable for progressive retrofit to any kind of signal system, on any kind of railway, anywhere, and at a small fraction of our foreign competitors' solutions to the same problem.

That would be the real breakthrough, and Network will keep you posted on developments.

Technical Checkout

So far in this series we have defined the elements of a railway signal system, and tracked the development of each element over the past 150 years. Now let's check out the application of the elements to a very modern signal system, on a very modern railway with some random examples. All the technology listed is in use here in Australia right now; the "for-instances" are in brackets.

- There are no insulated rail joints; the rails are continuous steel from terminus to terminus, including through the points (Mount Newman in the Pilbara).
- The system is fully track-circuited to detect trains, with "jointless" electronic track circuits applied to the continuous-welded rails; this equipment fails-safe (NSW).
- The signals are colour-lights, usually 3 sometimes 4 aspect. There is automatic block working to allow trains to follow each other between stations; this signalling arrangement fails safe, too (all railways).
- The points are electric-motor-operated. If trip arms are mandatory these "switch machines" may be electro-pneumatic as this option is cheaper. Point operation is not vital but the proving ("detection") of full and correct throw is absolutely "vital," and is therefore fail-safe (again all railways).

Equipment mounting for flood prone location Queensland CTC system installation.

- The points and signals are fully interlocked by a hard-wired all electric "relay interlocking" system applied to the "vital" circuits. This equipment involves hundreds upon hundreds of expensive signal relays, and is fail-safe. The circuits will be designed and drawn up with computer assistance, but be checked and double-checked manually (all railways).
- The remote control of signals and points is by telemetry over copper conductors in buried cables for local circuits, and for "trunk" circuits (increasingly) microwave radio or buried fibre optic cables using electronically modulated laser light. Being electronic, communications are decreasingly expensive in terms of channel capacity (microwave on most railways, fibre optics on QR).
- The interconnection of the "vital" elements at each field "location" is obviously itself vital, and the circuits are fail-safe; the "trunk" circuits are not. Nor, unless the interlocking is to be moved from the field to the "central office" is it necessary that they be. (Standard practice on all railways).
- Signal system power supply to field location is by a separate signals transmission line, remote diesel-generator sets, or solar cells, according to power demand. All are expensive. Reliability requires back-up systems. This is fail safe in the sense that every unlit signal is read as a danger signal (various supply solutions on various railways).
- All train movements are reported to, and all operations are controlled by the system operator(s) located in a "Central Office" for a main-line Centralised Traffic Control system, or in a "Control Centre" for a more compact but more complex "Area" signal scheme (such as a suburban network). These rather fancy panels with the display devices on them are very expensive; thus VDUs (colour TV) are coming into use. (Again, all railways; solutions vary).
- A computer tracks, reports and records the movements of the individual trains ("train describer" computer). It can also control all routine train movements and be arranged to drive platform indicator displays, synthesised public address announcements, etc. The computer is relatively cheap; its programming is expensive because almost every part of every railway is just that maddeningly little bit different. And often **totally** different (various computer applications on all railways, voice-synthesis is going into Adelaide).
- There will, if traffic densities and risks justify it, be a form of warning or other automatic system protection against the Driver's overrunning a red signal. If provided, this function is vital. It is expensive to prohibitively expensive (tripcocks in Sydney and Melbourne, AWS in Brisbane; Adelaide and Perth and moving to install this protection).
- There will be train to ground radio throughout the system, with automation of routine communications by display on cab panels to reduce unnecessary

voice traffic (radio is general; displays on QR).

- Level crossings will be protected by automatic barriers and lights, worked by the trains on approach track circuits (all systems).
- **All** the items of equipment will be systems-engineered and chosen for exceptionally high reliability. This insistence upon ultra-reliability adds to safety — and expense (standard practice).
- There will, on a main line and especially a heavy haul mineral line, be additional equipment such as hotbox and dragging equipment/derailed wheel detectors, even, perhaps, automatic flood warning devices at vulnerable points where there is a flash flood risk. All will be connected to the CTC signal system (Pilbara and elsewhere).
- Finally, if the railway is electrified (or likely to be) the complete signal system in every aspect will be thoroughly immunised against traction currents, harmonics and stray induced electrical voltages. So must the communications links on which it relies (Queensland and elsewhere).

All very safe indeed — and very expensive as well. What can be done to contain these costs, when today's signalling costs typically 15-20% of a new electrification scheme.

Way Out — Electro-Mechanical

Until quite recently the whole emphasis of modern signal engineering has been on electro-mechanical relays — pound-of-butter sized, precision-built, ultra-reliable electrical coils which operate multiple sets of contacts that are normally open i.e. closed only when the coil is energised ("front" contacts) or normally closed when the coil is de-energised ("back" contacts).

Using these coils and contacts, the safety system is built-up. If a safety function is arranged so that a current must flow to prove the "safe" condition (for example to prove that a track circuit relay is energised, prove there is no other vehicle present, prove the points are fully thrown via the blade detector switches — both of them — being closed, and a mechanical safety lock is likewise closed) all these contacts can be arranged in a form of series circuits to **energise** the coil of a signal relay. The signal relay coil energises; the front contacts close the switch on the green light, and the back contacts open to switch the red light off.

This is of course a very simplistic explanation — more like one of Robinson's 1872-type signal circuits than today's, which have numerous safety interlocks and clever sub-circuits to verify correct operation, protect against false feeds, detect burned-out light filaments, and so on. But however complex it may be, a relay interlocking scheme is comfortingly safe to the conservative signal engineer and maintainer. He can **see** the relays working, and the contacts opening and closing.

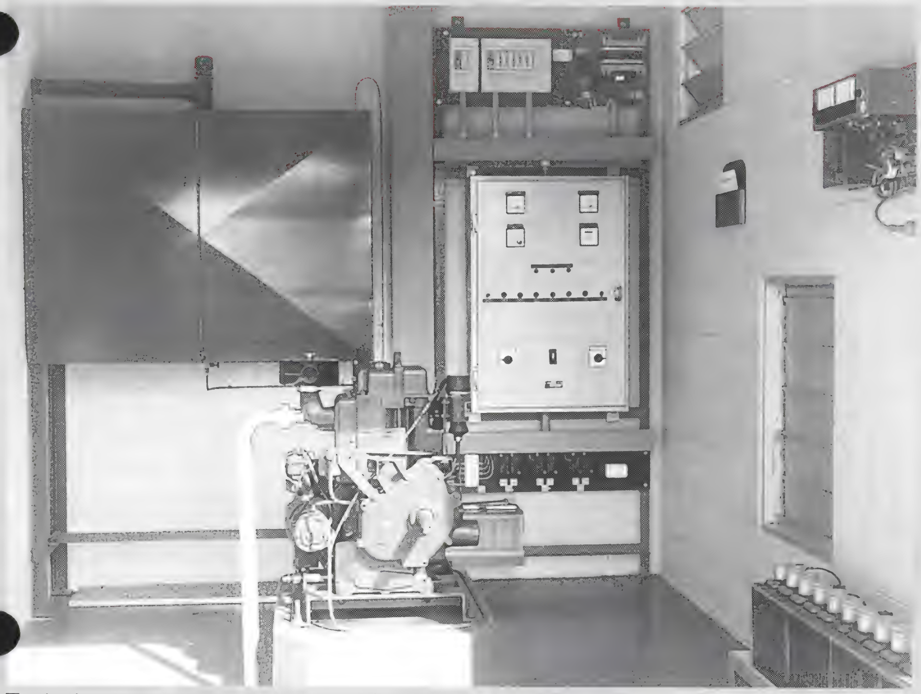
The only problem is that the special relays, originally developed as a "cheap" miniaturised substitute for the previous kitchen crockpot sized relays, can now cost $120-$180 each. And even in the relatively small interlocking of a country station there are hundreds of them — plus all the other equipment. The wiring is like a telephone exchange and it, too, must be spot-on, for the signal engineer is dealing with situations where crossed wires could cause not a wrong number, but a false green and an accident. Today relay interlocking schemes have reached the situation that the great 250-lever mechanical signal frames of city stations like Flinders Street reached in 1900: dinosaur proportions.

Milan Central (Italian State Railways) is probably the biggest dinosaur and the last great city station to be resignalled this way (1981-83). Its size approximates to Sydney Terminal and Sydney Central combined, but with much more track complexity and several times as many routing options. Here are some of Milan's vital signalling statistics: in the yard, 900km of cable in 18km of conduit and 30km of PVC pipe, feeding 100 tonnes of sheet-metal cabinets, i.e. equipment boxes. In the main relay room, 34,000 relays fed by 450km of cables, containing 1,400km of separated wires; these are carried on 83 tonnes of steel racks (modern **lightweight**-type racks). The control room has a thousand pushbuttons, nearly 8,000 individual mosaic "tiles" on the huge, theatre-screen sized track panel, and an unbelievable 40,000 luminous points — all of them light bulbs. And Milan is a computer-driven installation! But not, of itself, a giant electronic device or a primitive electro-mechanical computer. All the "vital" circuits at Milan use hard-wired copper and electro-mechanical relays. The computer is overlaid on this purely as a command and control device.

Way In — Solid State Interlocking

With **solid-state interlocking** (known as SSI) the functions of a hundred or more signal relays, and the kilometres of wires in the electrical spaghetti connecting them, can be combined into a few electronic cards. Microprocessors control and cross-check the vital functions. One big Swedish yard (Gothenburg) has had a pioneer large SSI running for several years, and all the leading signal manufacturers are developing SSI systems as fast as their research and development departments can (and their national railway clients are game to put on field trial). With such a system, it is vital for safety that there be totally independent electronic checks for each safety function, and that the independent answers agree (much the same philosophy is used in the autoland system for aircraft). An SSI system has to fail safe, and additionally, it has to diagnose its own faults, react safely to them, and report them. You cannot look at a chip, or listen to its click, to verify its operation.

Having disposed of the relays (said airily, to the dismay of most signal engineers) we turn to the cables linking them. Signal-quality cable is very expensive and here the important development is "vital" telemetry aimed at reducing the costly, complex "hard-wiring" or each individual, separate circuit with its own copper wire. Vital telemetry aims to bring to localised situations (e.g. the numerous hard-wired connections from the signal hut to outlying points and signals, the circuits along the line through which the controls of adjoining automatic block signals "talk" to one another etc) essentially the benefits that carrier telephony, microwave radio and fibre optics brought to **non-vital** long distance telecommunications. But "vital" telemetry cannot permit crossed conversations, wrong numbers, or the technical stuff-ups we are now resigned to accept as normal during interstate hook-ups of the ABC-TV News. "Vital" telemetry protects trains and lives. It has to be right-on, first time and every time. Which is why some conservative signal engineers (who cheerfully step aboard Boeings) tend to dispute the idea that any signal telemetry can be made vital.



Typical power supply room in a CTC equipment building with standby alternator.

Track Circuits

Our old friend Dr Robinson's track circuit is also under challenge, after an innings of 105 years. In very high-density locations (e.g. suburban railways) the track circuit is likely to remain with us — if only because most cities in our part of the world have renewed their signal systems and track circuits in the past decade. And in one city, barely in the nick of time, for cable breakdowns were starting to give "wrong-side" failures. Most of our main trunk lines are also substantially track-circuited with reasonably new equipment having typically 20-30 years' life ahead of it. The track circuit is also likely to remain on the busier heavy-haul mineral lines where the rails take very heavy cyclic stresses from high-axleload traffic. Ultrasonic detector cars (even the new world-beating all-Australian model called Ultrasound) do not **detect** every rail flaw before a rail breaks. Nor does a track circuit give the red-signal alert to every kind of broken rail. But a track circuit will catch most of those that slip through.

On lighter-trafficked lines, however — and even in the UK on some inter-city lines — the back-stop protection of continuous track-circuits against broken rails is, with today's highly efficient rail-inspection technology, starting to be regarded (by people other than signal engineers) as an expensive insurance policy. For the fact is that our intercity railways ran for decades under mechanical block signalling with no track circuits at all. Some still do. Very few accidents occurred from undetected broken rails on these sections, and track circuits will not detect the occasional summer problem of buckled track in hot weather.

The signal engineer has three modern alternatives to installing track circuits. Axle counters will accurately check (and double-check) the say, 280 axles of a train into a signal block, and lock it up until the next counter along the line has counted (and double-checked) exactly 280 axles out. Not 279, which would mean an equipment fault, or 276 suggesting that the last car might somehow have dropped off.

"Front of train" and "tail of train" checkout devices, either magnetic or electromagnetic, can sense the passage of a train and its failure to pass, i.e. to clear, a signal block. Combinations of these devices, sometimes coupled with short and therefore relatively inexpensive track circuits, can and are being used to provide all the essential fail-safe signal protection of a track circuit, and automatic block. They offer greater inherent safety than the classic British-style double and single-line manual block systems that we have used with an excellent safety record, for a hundred years. They also offer the main economic advantages of CTC, including superior traffic regulation and reduced ground staff.

For all but very busy lines one trend is towards reliable intermittent detection of the presence of a train, rather than the continuous detection of the track circuit. In Switzerland, for example, the Rhaetian Railways' Albula main line from Chur up to St. Moritz has always had non-insulated steel sleepers. It is single-track and electrified, and it works 50 trains daily (80 in the ski season peaks!) of up to 15 cars. It is very much a main line railway, despite its 1,000 mm gauge. Its CTC signalling uses a combination of local track circuits, axle-counters and "tail of train checkout" magnets that hang on the last coupler (they will not fit on any coupled couplers). In other essential respects, the Albula is a classic CTC installation — and its safety record is, like all things Swiss, impeccable.

Electronic Solutions

The North American Advanced Train Control System (ATCS) is a new-concept system, designed around "building block" sub-systems that will interface with each other and build up to create whatever level of signalling and traffic-regulation complexity and sophistication the situation demands. The "minimum" system is simple train protection and single line block; the "maximum" is full CTC with all the present trimmings, and more. The concept provides for the very real future potential of totally automated train control from a central office computer, to achieve optimised line capacity with minimum fuel burn and brake wear. Australian signal engineers intend to have a part of that action with **our** technology, and not somebody else's, and our industry is working expressly to achieve that end.

The Pilbara lines are well on the way to achieving it; the need for a Driver and his Sharp Lookout will remain on all but the completely automated subway, people-mover, or monorail.

The power supply problem in the field is being tackled with solar cells — all Australian railways are now using them. The shifting of points, however, calls for relatively high levels of power, and is not quite so easy to achieve from the sun. Perhaps somebody will come up with an easily rechargeable, non-electric "energy reservoir" for this (liquid nitrogen? We saw how the LSWR used C02 gas in 1903!) to reduce the electric power demand to the levels of working the control devices and lighting an electric lamp.

Radio

Radio — UHF in particular — is the path to future low-cost communications with microwave or fibre optic channels (both used here

(continued on page 62)

Clyde celebrates 2 Million Horsepower!

'N' Class Diesel Electric Locomotive 25 built for State Transport Authority - Victoria : 1985-87

CLYDE
2000000
HORSEPOWER

When locomotive N470 rolled out the door of Clyde's Melbourne factory in February 1987, it represented a landmark. Since 1951, when the first Diesel-Electric entered service in Australia Clyde has supplied diesel electric locomotives with horsepower totalling 2 million.
And there is a lot more to come.
Over the next 3 years Clyde will spend millions of dollars on computer integrated manufacturing systems and computer aided design facilities, adding to a substantial CAD investment already in place and working to put Australia into hi-tech motive power.

You're Training with CLYDE

CLYDE

Clyde Engineering

Motive Power Division

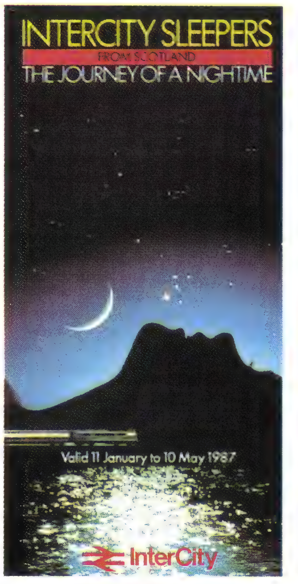
Clyde Industries Ltd.

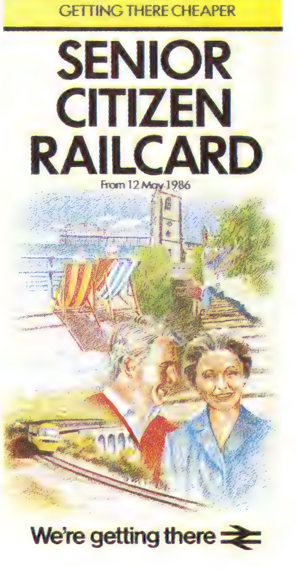
Sydney Ph. (02) 637 8288 Tlx AA72636 Fax (02) 637 8735
P.O. Box 73, GRANVILLE. 2142

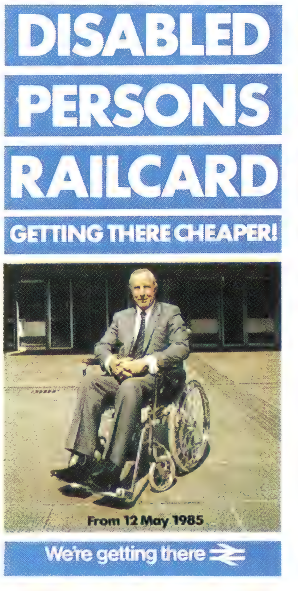
British Rail Brochures

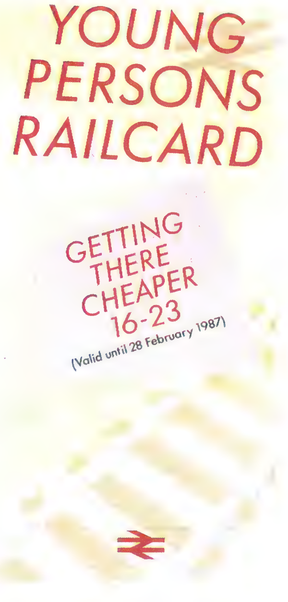
This interesting sequence of brochures released at Christmas by British Rail provides some insight to the specific market segment addressed by its marketing division.

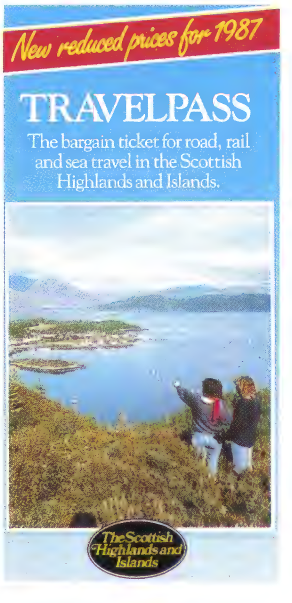
While a thematic treatment in the mechanical dimensions and fold characteristics is quite apparent each brochure is designed as a "stand alone" invitation aimed at a specifically identified market group. A number of the brochures are targeted to attract increased bookings during trough passenger periods.

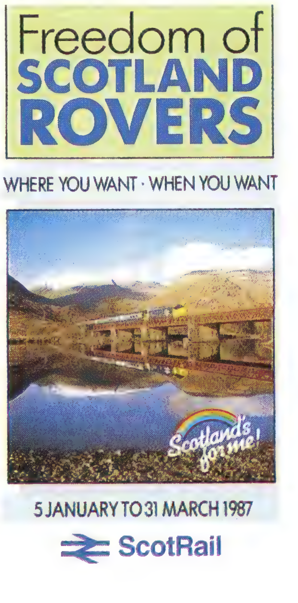












Pike Trophy goes to AN

By Peter Bramwell

There are not very many occasions when a railway yard wins a prize.

In November 1986, however, AN's Islington Freight Centre won the highly regarded S.E. Pike Trophy "for its innovative approach to intermodal transport at the Islington Freight Centre and in the Alice Springs corridor."

Awarded annually by the Australian Institute of Materials Handling, the S.E. Pike trophy recognises outstanding achievement and innovation in transport materials handling.

So what makes Islington a nationally recognised success? The simple answer must be what if offers AN's customers.

AN's intermodal operations were designed to enable faster, less labour intensive movement of pantechnicons, flatbed road trailers, and containers.

Where in the past this kind of operation relied on shunting and ramp loading procedures, the Islington approach is to use new technology to make the process quicker and better suited to forwarders' schedules.

Central to the design of the new freight yard was the acquisition of the 'piggypacker', a mobile crane for side loading trailers and containers onto wagons which can handle over twenty container or semi-trailer lifts per hour.

Manufactured by PPM of France, and featuring a versatile boom capable of lifting 40 tonnes, the piggypacker can load top and bottom lift containers, or road trailers fitted with lifting pads.

Rollingstock used in these operations is also noteworthy, having replaced the old securing system of ropes, chocks and chains with a single 'quick hitch' system that uses the trailers turntable mounting pin.

Containers are restrained by conventional container locking pins.

By having customers deliver their semi-trailer/container to a specific loading point beside the train and by pre-marshalling the train, the checking, preparation and loading times are reduced. Consequently, the intermodal freight forwarder can now deliver consignments as late as 30 minutes before train departure, for delivery in Alice Springs less than 30 hours later, providing the late afternoon drop-off and early morning collection schedule preferred by customers.

The application of new technology extends also to the assessment of freight loads.

Drivers of road vehicles report to the weighbridge where the load is

recorded on computerised equipment and are then directed to a detach point, adjacent to a nominated wag in the intermodal yard.

The piggypacker can handle over 20 'lifts' per hour.

or 'innovative approach'

Extensive paving both sides of each track at the Islington centre allows ample parking of trailers for despatch and a piggypacker at the Alice Springs intermodal freight centre ensures that goods are not delayed on arrival.

The first consignment on incoming trains is usually unloading within fifteen minutes of arrival and containers or trailers are unloaded at three minute intervals thereafter.

The objective of the $7.5m expenditure on a new yard at Islington, extensive additions at Alice Springs, special purpose wagons and piggypackers was to make intermodal freight movements by rail more attractive to forwarders.

The return to AN comes in the greater throughput of intermodal freight items, greatly reduced demand for consumable materials used to secure vehicles staff requirements reduced from five to two to load an entire train, drastically reduced pre-departure cut-off times and more streamlined train operations.

Train examination and air brake testing of the entire rake of wagons are carried out before loading commences.

The only subsequent operation required is to ensure brake continuity when the locomotive is attached. Islington has a unique system of air pipes under the paved areas of the yard, so the checking can be conducted without a locomotive.

Innovation, however, requires results. The results in this case are that more than seventy per cent of customers sending trailers to Alice Springs have converted to the intermodal system.

Customers have benefited from a 2-1/2 hour reduction in check-in times, 2-3/4 hour reduction in collection delays, and a reduction in transit times.

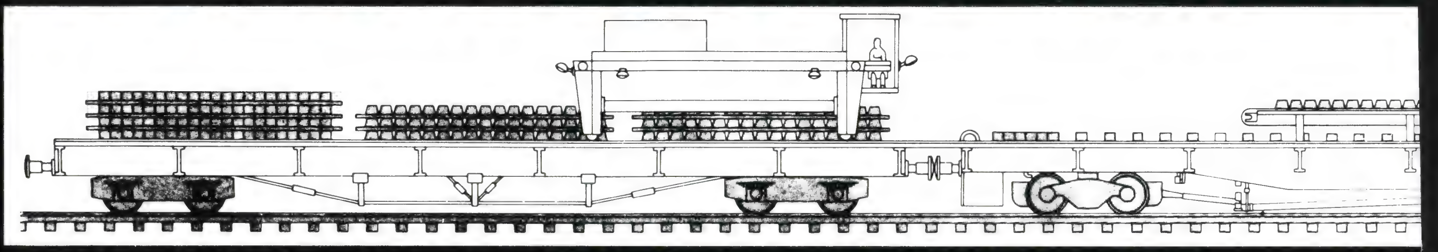
Greater efficiency in the yard has provided the means to achieve AN's strategy of running intermodal trains between Adelaide and Alice Springs, Perth and eastern capitals.

Previous winners of the S.E. Pike Trophy include Qantas Airways Ltd, TNT Materials Handling, Public Transport Commission of NSW, the WA Coastal Shipping Commission (Stateships) and Mayne Nickless.

Islington is evidence of AN's commitment to commercially successful operations, rather than relying on government support for freight services.

Winning this coveted award indicates AN is on the right track.

The track renewal train - r



The Tamper P-811S track renewal train is designed to remove old sleepers and rails, level and compact the ballast, and relay track with new rails and sleepers in one continual operation and in one pass.

While the machine is in operation, a self-propelled gantry mounted on running rails connecting the machine to the accompanying sleeper transport wagons unloads new sleepers from the wagons and feeds them to the sleeper laying conveyor unit.

On its return it carries the old sleepers back to the wagons.

Apart from the auxiliary personnel required for the handling and distribution of material at the worksite, the whole track renewal operation is carried out by four operators on the machine at a production rate of up to 600 metres an hour.

The train consists of a power unit vehicle and a track renewal vehicle. The latter carries the conveyor systems for the transport of old and new sleepers, the guidance system for the old rails, the sleepers pickup and laying machinery, and a ballast plough and compactor.

The frames for the guidance of the new rails are mounted on the beam of the power unit vehicle.

When working the machine pushes the sleeper transport wagons ahead of it on the old track that is to be lifted and replaced, while the bogie of the power unit runs on the newly laid track and sleepers.

At the junction of the two vehicles a bogie is fitted for normal track running to and from the worksite.

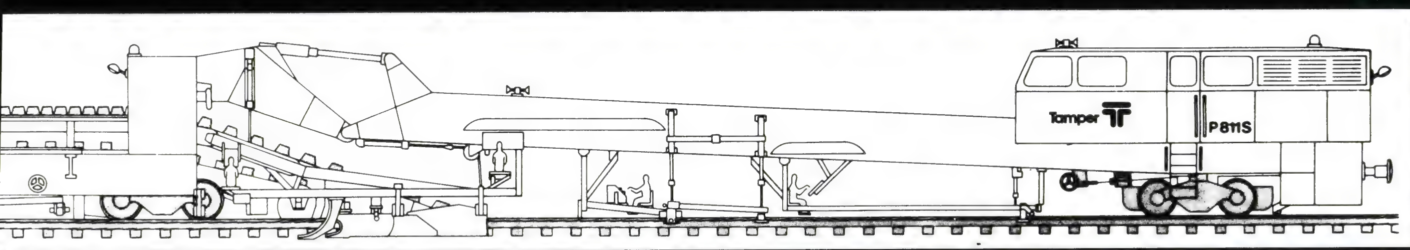
When working, this bogie is carried by a skid which slides over the old sleepers prior to their being lifted by the sleeper pick-up unit.

An arching beam between the two units of the train relieves the load on the skid when working.

This is a new TAMPER development which greatly reduces the overall length of the train in operation and also simplifies setting up on the worksite.

The Tamper track renewal model HSTR Mk III.

ewal of track in one sweep

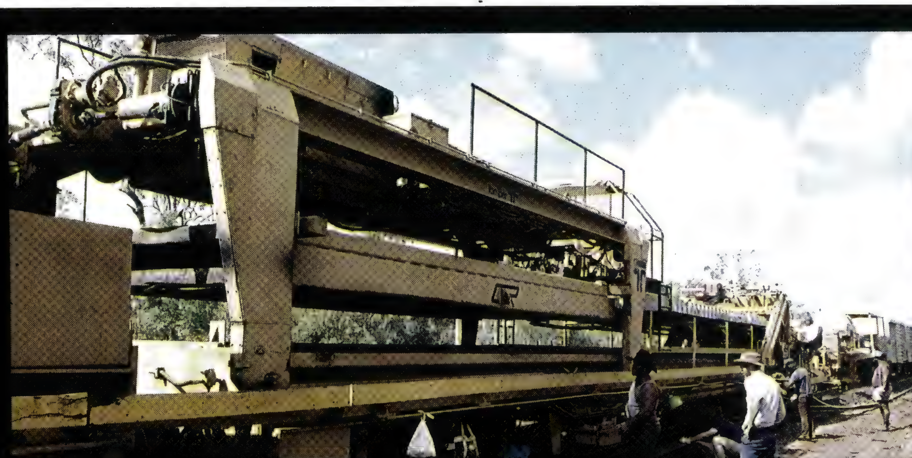


On arrival at the worksite the old rails are cut and spread, their place being taken by the skid.

The train is then advanced so that the wheels of the bogie rest on the skid and the work of track lifting and renewal commences.

At the end of the section to be replaced the old rails are cut to leave a gap of 3.5 m between them and the new rails.

The skid is then moved to butt against the old rails and the train advanced to run the bogie off the skid and allow the last sleepers to be laid to complete the rail connection with a 3.5 m section of rail to replace the skid.



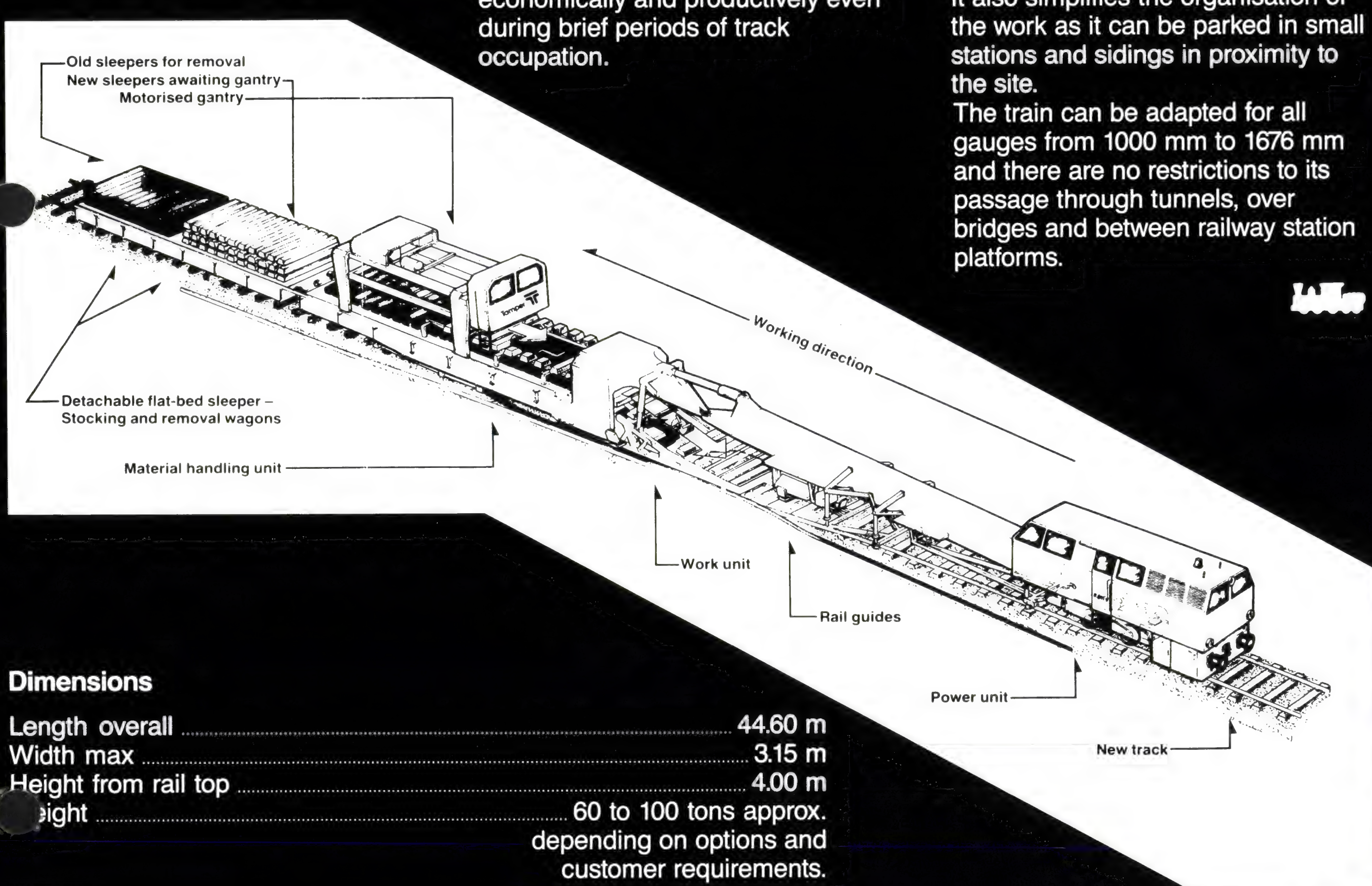
The P-811S showing the motorised gantry in operation.

The rapidity with which work can be started and the worksite cleared at the end of operations enables the track renewal train to be used economically and productively even during brief periods of track occupation.

The reduced length of the P-811S enables it to negotiate small radius curves both when working and in travelling.

It also simplifies the organisation of the work as it can be parked in small stations and sidings in proximity to the site.

The train can be adapted for all gauges from 1000 mm to 1676 mm and there are no restrictions to its passage through tunnels, over bridges and between railway station platforms.



Dimensions

Length overall	44.60 m
Width max	3.15 m
Height from rail top	4.00 m
Weight	60 to 100 tons approx. depending on options and customer requirements.

Alan packs it in after 42 years

Mr. A. J. (Allan) Evans, Queensland Railways Chief Supply Manager, retired on January 2, 1987, after more than 42 years with Queensland Railways.

Mr. Evans started with the Department as a Junior Clerk in the General Manager's Office, Brisbane, in September, 1944, and was subsequently appointed to classified positions as Assistant Private Secretary to Minister for Transport, Private Secretary to Minister for Transport, Clerk, Ministerial Section, Liaison Officer, Commissioner's Special Officer, Assistant Secretary, Administration Manager and retired as Chief Supply Manager, Redbank.

During his career he was associated with five Ministers for Transport and was Private Secretary to three of these Ministers.

Mr. Evans is a past Chairman of the Chartered Institute of Transport (Queensland Section) and is actively involved in community affairs.

Mr. Evans is suceeded by Mr. H.W. Smith (Hugh) as Chief Supply Manager, Redbank.

Mr. Smith, formerly Administration Manager, commenced his career in Cairns as a Junior Clerk in June, 1943.

Mr. Smith's experience comes from both the range of positions he has held and the training he has received outside the Department.

His first management position came when he was Officer in Charge of the Operations Section, then gained promotion to positions of Officer in Charge, General Section, Senior Personnel Officer, Senior Planning Officer (Operations), and later to Personnel Manager.

Mr. Smith has completed the Transport Industry Executives Course held at the University of New South Wales and is a member of both the Chartered Institute of Transport and the Institute of Personnel Management, Australia.

. . . and Jack Pitkeathly

Chief Electrical Engineer Jack Pitkeathly retired from Queensland Railways on Friday, February 6, 1987, his 60th birthday.

Jack started his career as an Apprentice electrical mechanic in the Telegraph Section, Roma Street, in January, 1943.

On completion of his apprenticeship he worked as a tradesman and completed a P.M.G. Course of training to qualify as a Telephone Technician.

He left Roma Street in 1956 to move to the Signal and Telegraph Engineer's office in the (then) Chief Engineer's Branch as an Assistant Draftsman.

Over the years he gained promotion to many positions in the Signal and Telegraph and the Electrical Sections and ultimately became Head of Branch as Q.R.'s first Chief Electrical Engineer.

Jack says the highlights of his career have undoubtedly been his heavy involvement in the Brisbane suburban and Main Line Electrification projects.

Network price rise

Subscriptions to 'Network' now cost $15.00 per annum if posted in Australia, and $18.00 if posted overseas by surface mail. The price of 'Network' in newsagencies is now $3.00, the first increase since 'Network' was originally published as a quarterly in 1982.

With ever increasing production costs, few magazines or newspapers could claim no price increase over a five year period.

Recent issues of 'Network' have carried additional full colour pages, making the magazine excellent value.

EDITOR

Westrail changes at the top

Westrail has made further changes to its top management with the appointment of Mr. Bruce Sutherland as Assistant Commissioner with responsibility for Marketing and Traffic Operations.

Mr. Sutherland has been Marketing Director since joining Westrail in 1981.

His appointment follows the departure of the Chief Traffic Manager, Mr. Mike Purcell, which has allowed the merger of the marketing and operational activities in Westrail.

Prior to joining Westrail, Mr. Sutherland was Managing Director of Huyck Australia Pty. Ltd., an industrial textiles manufacturer based at Geelong, Victoria.

Other previous experience includes sales and marketing management positions with major divisions of the TNT Group, executive directorship of a plastics raw materials manufacturer owned by General Electric and consulting experience in organisational development in the United Kingdom.

Mr. Sutherland graduated from Monash University in Melbourne, Victoria with a Bachelor of Arts Degree (Economics Major) in 1970.

A letter from the past

The first rail line in NSW, from Sydney to Parramatta, was opened in 1855 — about a year after a letter was published in the Cambridgeshire (England) "Chronicle" of December 9, 1854.

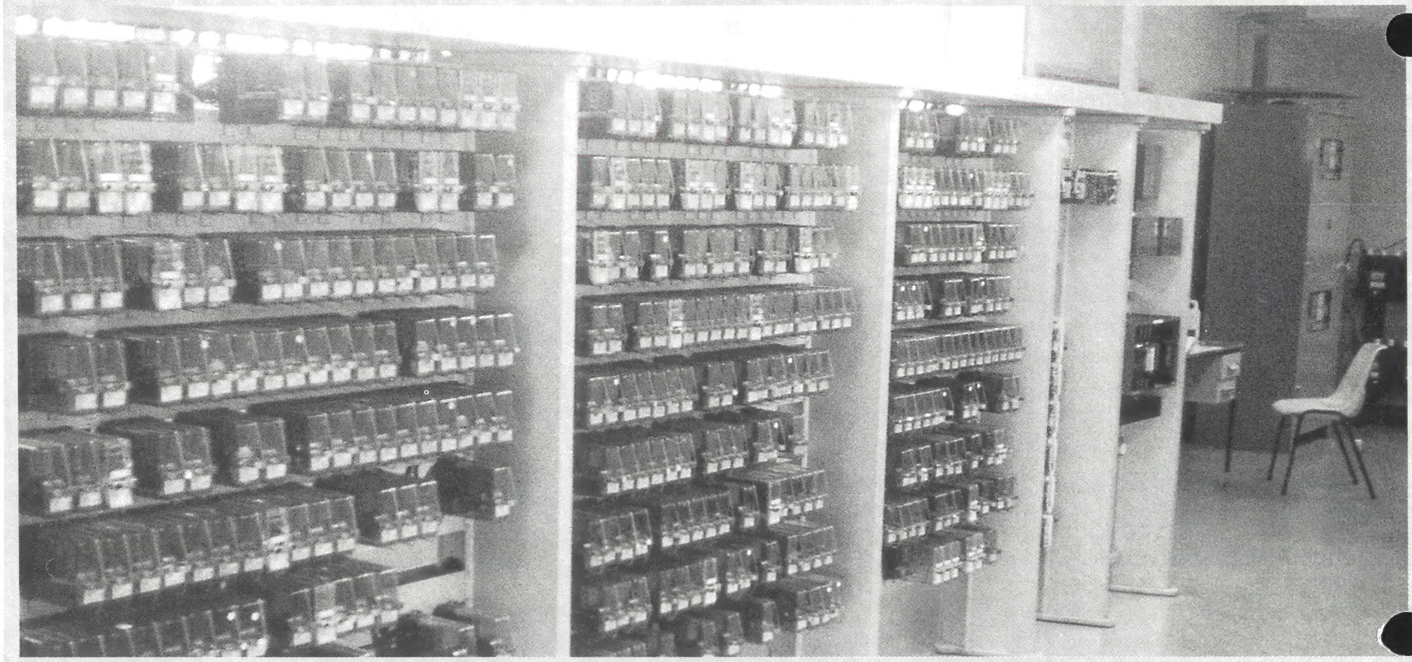
Parts of that letter reprinted here give an idea of the lifestyle and working conditions of the early "colonists" of Sydney who built the railway.

The letter was written for John Doggett, "a labouring man who emigrated to New South Wales from Waterbeach," by John Shipp — an ancestor of the wife of Stanley Maurer, State Rail signalman, Campbelltown.

"Ashfield, six miles from Sydney, Aug. 4th.
"Dear Mr and Mrs Cutting,
I write to inform you that we all arrived safe and sound at Sydney, after 92 days passage. I was sea-sick for about a month.
I was recommended by the doctor as nurse in the hospital: I got quite hearty there: I, John Doggett, was quite well, with the exception of a slight touch of the bowel complaint.
We lived well on board, and we was our own masters when we arrived.
We went where we pleased: we were not tied to the 5s 6d per day.
I am happy to say I am now earning from 16s per day to 1.
All tradesmen can do first-rate here, if they are steady; but they cannot do at home, if they are not: there is plenty of employment for all classes, particularly for hearty and strong young men: no doubt there will be plenty of employment for years to come.
They are building wonderfully at Sydney; and a great quantity of hands will be wanted on the railroad, such as bricklayers, carpenters, and blacksmiths, as there is no station built at present.
The line from Sydney to Parramatta, which is about fifteen miles, it is supposed will be finished in about a twelve-month from this time: the cuttings consist of rocks and pipe-clay: we are getting 3s 6d per wagon: we have to blast the rocks with gunpowder.
If you have any poor creatures starving, send them to Sydney; forgive them their debts and all well: they will be sure to send you all they own: they will have a chance here to do so.
I have myself for dinner this day two plum puddings, sirloin of beef baked over a pudding, and a cauliflower as big as your head; turnips, also potatoes.

I am living within sight of the railroad: we live in a good hut on the railway property; we live rent free, no rates, no taxes, no firing to pay for; we can cut all we like; we go in the bush. The bush is green at all times of the year; instead of dropping the leaf, it sheds the bark.
We are now in the depth of winter: I have not seen any ice thicker than a shilling; no snow; but I have heard there are mountains where it lays all the year.
I have seen hail-stones as big as walnuts. Thanks be to God that I am here: I am also much obliged to Mr. Witt for sending one here, and may God bless him and his family, and I hope he will have more corn and less rats.
We have a good road, but we are in the bush, but inhabited all around.
You would have laughed to see me bring a carcase of mutton home: that is better than buying ½lb of suet.
We don't want for nothing fat: I go to Sydney every fortnight, buy my shop goods, flour & c., & c. You can have things at Sydney the same as at London.
I am happy to inform you that I have Thomas Markham, his wife and family in the next hut to us: they are all quite well; they have only six children, but they live well daily, and are as fat as pigs.
I am happy to say if I have a little cold I can have a glass of hot rum and water going to bed, not to be satisfied to get change for a penny for a half-a-pint of beer: I can keep both rum and gin in the house, if I think proper.
I have poultry and dogs, goats: eggs are 4d each.
Charley gets 36s per week: he is brakesman on the railroad; he wears good clothes, and everybody respects him, that is, that know him.
When I hear from you, I will send you more news about the country: it is a fine country to live in. It is now 12th Oct., and as hot as at midsummer.

"Yours respectfully,
"John Shipp,
"For John Doggett, Waterbeach, Cambs."



CTC interlocking equipment in station building at Pring on Abbot Point-Collinsville Line.

(continued from page 49)

now) for high-density long-line bearers. Radio is used extensively for communications, and on QR and the Mount Newman iron ore railways, for remote control of assisting mid-train locomotives. It is the basis of a pioneering "low cost CTC" system in British Columbia — a system not without its problems, but a nonetheless praiseworthy attempt to bring the latest electronic and communication technologies to the railway by leapfrogging across the classic electro-mechanical signal hardware.

The major difficulty with radio is obstruction of signal propagation by terrain. Radio-based systems are fine in flat country, but if radio has to be depended upon for vital functions like the precision-tracking of a train's location, the propagated signal has to cover virtually everywhere, and in the mountains this can be expensive because of the need for numerous repeater stations. It does not matter too much if the taxi-driver in an underpass loses radio contact with Base, and misses out on a fare. If the control centre "loses" a train the safety system has to assume the worst for fail-safe reasons, and lock that section of line up until the train — all the train and definitely the right train — is positively proven to be somewhere else. Fail-safe applies yet again.

The Future

The art of prophesy has always been a risky one and with electronic technology, the risks of prediction are particularly high. Remember how we were told colour TV was so complex it would always break down? We have already alluded to a very promising Australian development in the train protection area that could well upset the apple-cart; inventive young minds are doubtless working on many others.

Which brings us back full-circle to the signal engineer and the signal technician on whom he or she depends. Where will they be in 10-15 years' time? Indeed, **who** will they be if he or she, and the employing railway (or company, or consulting house) are to be successful? Certainly they won't be wedded to traditional electro-mechanical ironmongery, thousands of relays with gold-tipped contacts, and hundreds of kilometres of costly wire with individuallly-soldered connections. But equally certainly, the signal engineer will be the man or woman to uphold the great tradition of safety — of exceptionally rare failures, of always failing-safe — laid down by the great signal engineers of the past. People like Gregory, Saxby, Farmer, Tyer, Welch, Holland, McKenzie, Robinson, Sykes, Coligny, Chambers — all of whom made their contributions to the outstanding safety of our railways. And none made a greater contribution than the wise men who founded the Institution of Railway Signal Engineers in 1911, to organise and promote these high standards.

Now the established, disciplined order of doing things has been greatly upset by electronics and computers. He or she who is strong in these disciplines, and knowledgeable in the fundamental principles of the railway, its safety, and its operational need will prosper. And with such people, the railway or the company will also prosper.

Age is not of consequence, if the mind be flexible and willing to learn new disciplines. Sixty years ago, the writer's father in-law was Australia's leading exponent of double-wire mechanical signalling. A McKenzie and Holland man from Spotswood, Victoria, he later installed the Westinghouse power frame at Cardiff GWR; founded a small carrier-telephony business (in the Depression!); went broke; and applied double-wire railways signalling principles during World War 2 to clean up the messy flying controls of military aircraft designed by aircraft and not signalling experts.

Today's Sentinels of Safety are no longer the tall, tapered hardwood posts with their graceful semaphores. Nor are they the racked cards whose clever electronic functions cannot even be guessed at by a visiting expert unless he knows the part number. Today's real sentinels of safety are, as they always were, people. They are the two hundred or so Australians who can, when asked what their job is, reply with quiet pride: "My job's terrific — a really challenging one. You see, I'm a railway signal engineer."

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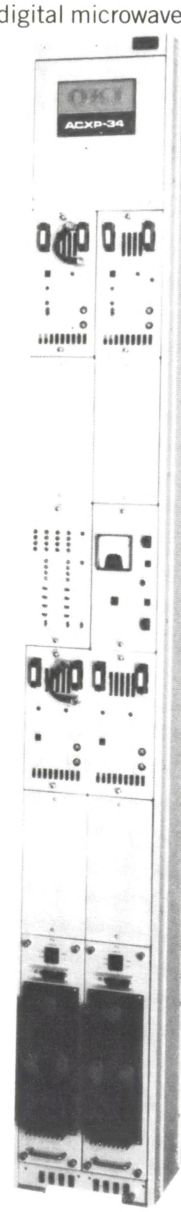

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